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THE MEXICAN CENTRAL RAILWAY'S MONSTER LOCOMOTIVE—DESIGNED BY F. W. JOHNSTONE.—[See page 135.]

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NEW YORK, SATURDAY, MARCH 4, 1893.

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No. 896.

For the Week Ending March 4, 1893.

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AMERICAN OCEAN COMMERCE.

At one time the United States was awarded the supremacy of the seas. For many years the modeling of ships had not received due attention in the older countries. The shipbuilders of the old world had evolved a type of vessel which as a sailer was very unsatisfactory. In the new world the genius of the Americans seemed to find a congenial occupation in ship building. In very early days we read of their great sloops, one-masted vessels, performing ocean voyages supposed to be beyond the capacity of this type of vessel. Soon the schooner was evolved, and going back over a hundred years, we find the Baltimore clippers, as the most famous type of schooner was called, enthusiastically depicted. The industry of whaling was early established at Nantucket and, spreading to other ports, soon distributed representative American ships all over the seas. The California and China trades were entered into and the American clipper, of New England or New York build, won laurels for herself in many a race half way around the globe. Ships of the same type gave a good account of themselves in transatlantic work.

It is not only the skill of the American shipbuilder that brought about the triumphs of our shipping. The *personnel* of the service ranked very high. The conditions of life on American ships conduced to individual responsibility. On the whale ships a young man barely in his majority would sometimes be captain, and start from Nantucket or New Bedford on a three years' cruise. In the fishing ports, sooner or later, every man of any standing would be in command of a fishing smack, and most daring exploits would be carried out. The flat-bottomed sharpie, drawing but eighteen inches of water, has, it is said, gone as far as the West Indies.

Thus in the old days of sailing vessels the enterprise of Americans gave them a high record upon the seas of both hemispheres.

With the advent of steam and the new conditions established, and with her merchant marine ruined during the war, America was at a great disadvantage in the race for commercial prosperity. The general feeling of the country was opposed to the granting of subsidies. Great Britain, on the other hand, has strained every nerve to attain supremacy on the ocean. As iron and steel ships have come to be the standard, the advantage in cost of building has been distinctly hers. In addition to this, the government has been lavish in its subsidies, and the White Star, Cunard, and Inman ships on the Atlantic and the Royal mail lines on other oceans testify to the results of this policy.

The English ship companies have also adhered to the English scale of compensation in their salary and wage lists. An important economy is doubtless obtained in this division of expense, as compared with the higher salaries which prevail on our side of the ocean. The English shipbuilders have reached their highest point in such ships as the City of Paris and City of New York. For some time past these ships have figured as record breakers on the Atlantic passage.

Wa elsewhere describe the ceremonies which attended the transfer of the New York, formerly the City of New York, to the American flag. The United States have, by a law destined to have far-reaching consequences, acquired the Inman steamships as the basis of an American line. Officered by Americans, the New York and Paris, marking the highest development of the English shipbuilder's art, are now to try their prowess under the American flag. It will be interesting to see how the new auspices will affect the records of these ocean racers.

The general provisions of the new law under which the transfer was made we give elsewhere. One of the most interesting provisions is the one calling for the construction of American ships. Under the new law, in whose passage all political parties united, the new American line must build American ships. Already the contracts for two ships are awarded. The typical American shipbuilding firm, who have received the contracts, will do their utmost to surpass the New York and Paris. The transatlantic record will hereafter be international in character.

The awarding of bounties or subsidies is provided for in the new law. This is not done on any theory that might raise a political issue. The ships are subsidized as part of a naval reserve. The New York and the Paris are specially built for such use. The new ships will also be of the same character. Fitted out with a main battery of twelve six inch rifles, besides an adequate secondary battery, the New York and Paris will be of great value in time of war. The history of modern warships in their practice and service cruises is one story of troubles. The speed falls below their rating, their boiler tubes leak, and all kinds of difficulties seem to befall them. But in ocean steamships the highest efficiency of engines, ship, and crew is maintained as a matter of profit. The ship must work up to high pressure always and must always be in the best possible condition. The competition will now be hotter than ever. In the ships of the American line the United States will have war vessels which even in action with armored ships might develop unexpected capacity. As commerce destroyers they will be very effective. The exploits of the Alabama during the civil war may be repeated on an enemy's commerce, and ocean tramps may be captured *ad libitum* by such ships as the American line will hold ready for service.

The batteries for the ships will be kept in readiness for instant transfer to the decks and tops of the vessels; the vessels will be always in the best possible condition. We may not only look upon the great development of American shipping which is now to be brought about as a most important effect, but we must also remember that at nominal expense the American navy is to be increased by nearly ten thousand tons.

The enrollment of coasters for possible service in the navy has been in active progress for some time. On the great lakes a movement in the same direction has taken place. The total tonnage of American commerce is already very large. In the addition thereto of the American line it receives a new type of vessel and a most important accession. This is precisely the type which has been lacking. The epoch is a well defined one, and its best feature is that politics did not appear in it. It is the work of the nation, not of a party.

Hard and Soft Phosphates.

At the last annual meeting of the American Association of Official Agricultural Chemists, Mr. N. T. Lupton referred in his presidential address to the immense phosphate beds in the southwestern part of Florida. Two winters ago a visit was paid to some localities where deposits are found, and samples were collected for analysis. They were of two varieties, which may be called hard and soft. The hard variety consists of bowlders of moderately hard rock, some of immense size, cemented together with white clay. A white and friable mass resembling kaolin is occasionally found. This is probably produced by the natural disintegration of the hard rock by rolling, attrition, or concussion. The deposits vary in thickness. A depth of 20 or 30 feet is not uncommon, and even a thickness of 50 feet has been found. As some, especially foreign, manufacturers object to buying phosphates which contain over 3 per cent of oxides of iron and aluminum, large quantites of these materials have accumulated at the mines. A few manufacturers, aware of the agricultural value of South Carolina floats, have established mills in Florida for pulverizing these soft aluminous deposits, which are sold to farmers for use without conversion into soluble phosphates. Experiments are now in progress on the Alabama Experiment Station, under control of the chemist, to determine the chemical composition and agricultural value of these soft phosphates when used alone with cotton seed and with cotton seed meal. If decomposing organic matter, as is believed, renders insoluble phosphates available as plant food to any considerable extent, Mr. Lupton thinks that the question of cheap phosphates will be solved, and that the American farmer will be enabled to purchase fertilizers at a much less cost than at present.

Lithia Waters.

It is one of the curious developments of modern medicine that remedies largely used by practitioners for years are suddenly shown to be lacking in the powers generally attributed to them. For years the profession has used lithia water in various diseases, with the idea that the results obtained were due to the comparatively small quantity of lithia present in solution. Those physicians who examined the subject closely speedily concluded that the greater part of the benefit derived by patients from so-called lithia waters depended rather on the large amount of pure water ingested than upon the lithia contained in it. In other words, the pure water practically flushed the body of impurities. These conclusions were still further supported by the discovery on analysis that one of the widely advertised lithia waters, indorsed by a large number of misguided persons, was only a pure water, with practically not a trace of lithia in it. Still more recently, Haig has told us that while lithia speedily combines with uric acid in a test tube, in the body it has a greater affinity for the acid sodium phosphate in the blood, and combining with this leaves the uric acid untouched. Lithia waters should be used, not for their lithia, but for their purity, and the results obtained placed to the credit of the flushing of the system, not to the lithia.—*Therapeutic Gazette.*

Natural Gas at Geneva, N. Y.

Mr. S. K. Nester, maltster at Geneva, has just successfully completed sinking a well on his premises and from which he has obtained an enormous flow of natural gas. He will use it throughout his immense plant, and the New York Central Iron Works Company, manufacturers of the celebrated Dunning steam and hot water heating boilers, have secured the first contract for the use of the gas, to be used for operating and lighting their entire plant.

POSITION OF THE PLANETS IN MARCH.

SATURN

is morning star until the 29th, and then evening star. He wins the place of honor on the March record, for he is in opposition to the sun on the 29th, at 5 h. 12 m. P. M., when he is under the best conditions for terrestrial observation during the present year. The ringed planet when seen at his greatest brilliancy must be in opposition when near perihelion, and in high northern declination, with his rings open to their widest capacity. These three events occurred in the year 1885, when Saturn was in opposition December 26, in perihelion October 21, and in 22° 31′ north declination when in opposition. They will not occur again until about 1915, when the planet has completed another thirty years' revolution around the sun. After 1885 the rings seemed to be closing around the planet until 1891, when, being seen edgwise from the earth, they apparently disappeared, or were visible as a thin needle of light projecting on each side of the planet, showing that a quarter of a revolution had passed. They are now slowly opening and will continue to develop this phase until about 1900, when they will be open to their widest extent, the northern side being illuminated. The rings will again disappear after the passage of seven or eight years, and about 1915 will be again widely open, the southern side being illuminated, and the planet visible in his best estate. The opposition of Saturn on the 29th is not a brilliant one, for he is more than halfway on his course to aphelion, when he is 50,000,000 miles farther from the sun than when in perihelion, and his rings, on whose phases his brilliancy greatly depends, are just opening, while his southern declination is increasing. He is none the less a fine telescopic object as his rings slowly open, and give promise of changes to come as the years roll on.

Saturn observed with the naked eye shines as a first magnitude star, distinguished from his twinkling companions by his serene pale light and leaden tint. He rises at 8 o'clock on the 1st, and about four minutes earlier every night until the 29th, when he appears above the horizon at sunset and is visible the entire night. He may be easily recognized in the east, being on the middle of the month about 9° north of Spica, and nearly 2° east of Gamma Virginis, a famous double star among the first that were discovered. It is also a variable, its two components varying from the third to the third and a half magnitudes. The components are 5″.5 apart, and the color is silvery white with a tinge of yellow. The stars revolve around their common center of gravity in 185 years. Gamma Virginis is an easy object for a small telescope, and its position near Saturn affords a fine opportunity for the telescopic observer, who will have no difficulty in finding the star. As Saturn is retrograding or moving westward, he is seemingly approaching the star.

The moon is in conjunction with Saturn twice during the month. The first conjunction takes place, two days after the full, on the 4th, at 6 h. 36 m. P. M., the moon being 1° 12′ south. The conjunction is invisible, as it occurs when the actors in the scene are below the horizon; but moon and planet will be near neighbors when they rise about 8 o'clock. The moon will occult Saturn and also Gamma Virginis for southern observers who see the moon in her geocentric position and who are between the limiting parallels, 33° and 90° south.

The moon is in conjunction with Saturn for the second time, a few hours before the full, on the 31st, at 10 h. 24 m. P. M., being 1° 5′ south. The conjunction is visible, the hour is convenient, and Saturn is so close to the moon that he makes an appulse, or seems nearly to touch her northern limb. The moon rises on the 31st, near sunset, Saturn follows soon after, and between them is found Gamma Virginis, nearly hidden in the moonlight, the star the smallest in appearance of the trio, but in reality exceeding the sun eighteen times in mass, and shining with eighteen times the intensity of our central orb. It will be interesting to watch the moon's approach to the star and planet, the conjunction with each in turn, and the moon's recession as she moves on her eastern course. Southern observers are more favored than their northern friends, for what is here a conjunction is there, under the right conditions, an occultation, first of the star and then of the planet.

The right ascension of Saturn on the 1st is 12 h. 46 m., his declination is 2° 5′ south, his diameter is 18″, and he is in the constellation Virgo.

Saturn rises on the 1st at 8 h. 8 m. P. M. On the 31st, he sets at 5 h. 55 m. A. M.

MERCURY

is evening star until the 31st, and then morning star. He reaches his greatest eastern elongation on the 14th, at 4 h. P. M., when he is 18° 27′ east of the sun. This is one of the best opportunities of the year for observing Mercury as evening star. He may be found at elongation and for a week before and after. His light number on the 9th is 71.1, the highest for the year, and he is then at his greatest brilliancy. We give his position at elongation, when he sets an hour and three-quarters after the sun. The observer must command a good view of the western horizon, and commence the search three-quarters of an hour after sunset. Jupiter, easily visible, will guide him to the little planet he seeks, for Mercury will be found 15° southwest of Jupiter and 9° north of the sunset point, shining in the evening twilight as a first magnitude star, with a wonderful luster, resembling Sirius, though not quite so bright. Any painstaking observer will find this shy and beautiful planet, remembering to use an opera glass as an aid. Mercury is in inferior conjunction with the sun on the 31st, at 9 h. 24 m. P. M., when he passes between the earth and the sun, and becomes morning star.

The moon, two days after her change, is in conjunction with Mercury on the 19th at 2 h. 41 m. A. M., being 4° 39′ south.

The right ascension of Mercury on the 1st is 23 h. 34 m., his declination is 3° 25′ south, his diameter is 5″.6, and he is in the constellation Pisces.

Mercury sets on the 1st at 6 h. 39 m. P. M. On the 31st, he sets at 6 h. 24 m. P. M.

URANUS

is morning star. He is so near opposition that he is now visible to the naked eye as a faint star of the sixth magnitude, about 18° southeast of Spica, and 3° northwest of Alpha Librae, a star of the third magnitude. Uranus is surrounded by faint stars, making it difficult to distinguish him from his companions; but if a small telescope sweeps the field, he will appear as a disk of a delicate green tint, showing that he is a planet, while the neighboring stars are mere points of light, no matter how high the magnifying power may be to which they are subjected. His position once known, his course can be readily followed with the unaided eye.

The moon, three days before the last quarter, is in conjunction with Uranus on the 7th, at 4 h. 28 m. A. M., being 1° 35′ south.

The right ascension of Uranus on the 1st is 14 h. 33 m., his declination is 14° 34′ south, his diameter is 3″.8, and he is in the constellation Libra.

Uranus rises on the 1st at 10 h. 40 m. P. M. On the 31st, he rises at 8 h. 38 m. P. M.

NEPTUNE

is evening star. The moon is in conjunction with Neptune, two days before the first quarter, on the 22d, at 10 h. 39 m. P. M., being 5° 11′ north.

The right ascension of Neptune on the 1st is 4 h. 28 m., his declination is 20° 13′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune sets on the 1st at 1 h. 2 m. A. M. On the 31st, he sets at 11 h. 4 m. P. M.

JUPITER

is evening star. Even this mighty planet must succumb to a higher power, and the present month practically closes his career as evening star, for after its passage he will be too near the sun to be visible. The moon, three days after her change, is in conjunction with Jupiter on the 20th, at 3 h. 37 m. A. M., being 1° 7′ north. The conjunction and resulting occultation will be invisible, moon and planet being below the horizon.

The right ascension of Jupiter on the 1st is 1 h. 33 m., his declination is 8° 37′ north, his diameter is 33″.4, and he is in the constellation Pisces.

Jupiter sets on the 1st at 9 h. 20 m. P. M. On the 31st he sets at 7 h. 56 m. P. M.

VENUS

is morning star. It will take sharp-sighted eyes to find her, as she rises only 28 minutes before the sun on the 1st and 7 minutes on the 31st.

The right ascension of Venus on the 1st is 21 h. 53 m., her declination is 14° 2′ south, her diameter is 10″.4 and she is in the constellation Aquarius.

Venus rises on the 1st at 6 h. A. M. On the 31st she rises at 5 h. 33 m. A. M.

MARS

is evening star. He is fading into invisibility and his course is devoid of interest. His right ascension on the first is 2 h. 38 m., his declination is 16° 13′ north, his diameter is 5″.8 and he is in the constellation Aries.

Mars sets on the 1st at 10 h. 53 m. P. M. On the 31st he sets at 10 h. 36 m. P. M.

Mars, Jupiter, Saturn and Neptune are evening stars at the close of the month. Mercury, Venus and Uranus are morning stars.

Recent Decisions Relating to Patents.

CONSTRUCTION OF CLAIMS.

The United States Circuit Court holds that where an applicant acquiesces in the rejection of his original claims by filing a disclaimer, submitting modified claims, and accepting a patent therefor, such claims must be strictly construed. 1.

PATENTABILITY—WANT OF NOVELTY.

Patent No. 254,085, July 21, 1882, to Wesley Young, for an improvement in "plashed hedges," being simply for a wire extending along the base of a hedge near the ground to prevent the passage of small animals before the shoots of the hedge are grown, is void for want of novelty, it being old to use such a wire to keep the plants in position, and to give the hedge increased lateral strength, and it being old to use a wire along the base of an ordinary fence to prevent the passage of small animals. 2.

The third, fourth, and fifth claims of letters patent No. 233,393, issued October 19, 1880, to Charles Barnes, for an automatic fire extinguisher, which claims are for a valve-releasing device, consisting of wires, a lever, and a fusibly-jointed slide, and the combination of a perforated distributer, a valve located in the distributer, having a stem which projects through the shell of the distributer, and a lever to hold the valve to its seat, are void for want of novelty. 3.

PATENTABILITY—COMBINATION.

Claim 2 of letters patent No. 238,147, issued February 22, 1887, to John Demarest, for an improvement kindred to letters patent No. 170,709, issued December 7, 1875, to William S. Carr, for an improvement in waste valves and overflows for baths and basins: "The tube, *a*, provided with the collar, *i*, and lock nut, *l*, for clamping the slab, *m*, in combination with the tubular stem, *f*, of the valve, *e*, passing through the lock nut, *l*, and means for sustaining the tube, *f*, when elevated, substantially as set forth," is for a mere aggregation of parts without co-operating action, and not for a patentable combination. 4.

EXTENT OF CLAIM.

Claim 1 of letters patent No. 262,169, issued August 1, 1882, to Edward Wilhelm, for an improved locomotive headlight, covers "a reflector provided with an opening behind the burner, whereby light is emitted backwardly into the headlight case for illuminating signal plates or lenses applied to said case, substantially as described" The Circuit Court of Appeals held that, in view of the pre-existing headlights, the claim must be limited to a reflector having an opening near its apex separate from the burner hole or chimney hole of those devices. 5.

In letters patent No. 170,239, issued November 23, 1875, to Lucien S. Crandall, for an improvement in typewriting machines, the specifications show a vibrating platen to give more than one printing center, and type bars with two or more types, and having a forward or backward motion, so as to use two adjoining types on each printing center. Claim 3 is for "the combination of the vibrating platen with the swinging compound type bars, provided with types corresponding to each vibration on printing point of the platen, substantially as specified." The United States Circuit Court decided that the claim covers the combination of the vibrating platen and the type bars with more than one type, and the word "compound" does not confine the claim to bars having both plural types and a double motion. 6.

Letters patent No. 170,709, issued December 7, 1875, to William S. Carr, for an improvement in waste valves and overflows for baths and basins, claim: "The tube, *a*, provided with the collar, *i*, and lock nut, *l*, for clamping the slab, *m*, in combination with the tubular stem, *f*, of the valve, *e*, passing through the lock nut, *l*, and means for sustaining the tube, *f*, when elevated, substantially as set forth." The Circuit Court of the United States held that, in view of the prior state of the art, as shown specially by the patent of July 21, 1874, to J. T. Foley, the patent must be limited to the specific mechanism described. 7.

LICENSE.

C., the owner of letters patent, by a power of attorney appointed Y. his "sole agent" for the "purpose of working and developing the business of the said patents," for and in consideration of a specified royalty "upon every lever fitted upon any railway in the United States," etc., to be paid by Y. to C., "with power for the said Y. to negotiate the sale of said patents upon terms to be agreed upon." By an instrument of writing executed by Y. in his own name, and as his own act and deed, without the consent or knowledge of C., nor his subsequent acquiescence, Y. granted to a coporation, its successors and assigns, "the sole and exclusive right and license under said recited patents to make, use, and sell the improvements therein described and claimed, or intended so to be, to the full ends of the respective terms of said patents," with a proviso that the grantee pay to Y. the said royalty. The court decided that this was an attempted sale by Y. of the entire patents, and, being unauthorized by his power of attorney, was inoperative to pass the title thereto as against a subsequent grantee of C. 8.

1. J. L. Mott Iron Works *v.* Standard Mfg. Co., 51 Federal Reporter, 81.

2. Young *v.* Baltimore County Hedge and Wire Fence Co., 51 Federal Reporter, 109.

3. Barnes Auto. Sprinkler Co. *v.* Walworth Mfg. Co., 51 Federal Reporter, 88.

4. J. L. Mott Iron Works *v.* Standard Mfg. Co., 51 Federal Reporter, 81.

5. Steam Gauge and Lantern Co. *v.* Williams, 50 Federal Reporter, 931, July, 1892.

6. Remington Standard Typewritter Mfg. Co. *v.* Bailey, 50 Federal Reporter, 933, June, 1892.

7. J. L. Mott Iron Works *v.* Standard Mfg. Co., 51 Federal Reporter, 81.

8. Johnson Railroad Signal Co. *v.* Union Switch and Signal Co., 51 Federal Reporter, 85.

THE MANUFACTURE OF DYNAMITE.

It will soon be twenty years ago (it was, as well as I can remember, along about 1873) that a few friends and I were returning from Lucerne to Florence

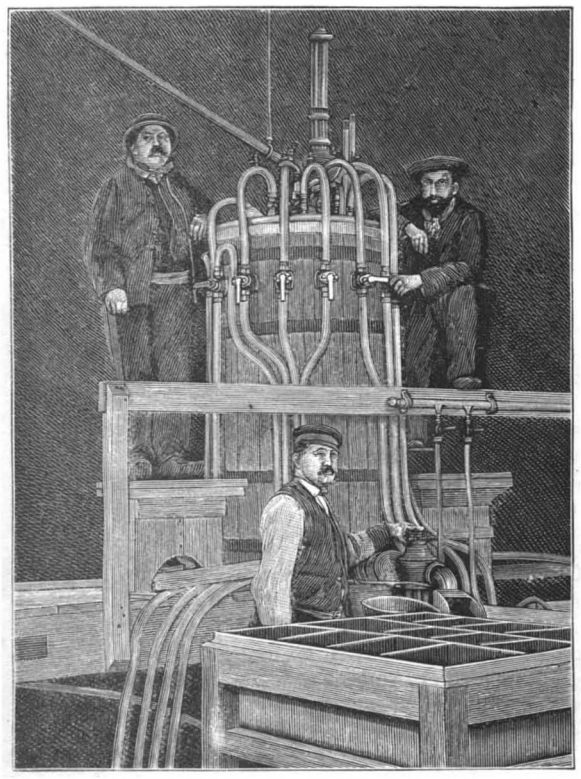


Fig. 1.—NITRO-GLYCERINE APPARATUS.

by the steamboat that performs the service of Lake Quatre-Cantons. At that time, now so remote, it was the only means of conveyance that took tourists, as also the peaceful inhabitants of the primitive cantons of Switzerland, to the St. Gothard route, and thence to the sunny plains of Ticino and Lombardy.

The first blows of the pick were then being given to the granitic sides of the mountain which, eight years afterward, were to hear the snorting of the locomotive

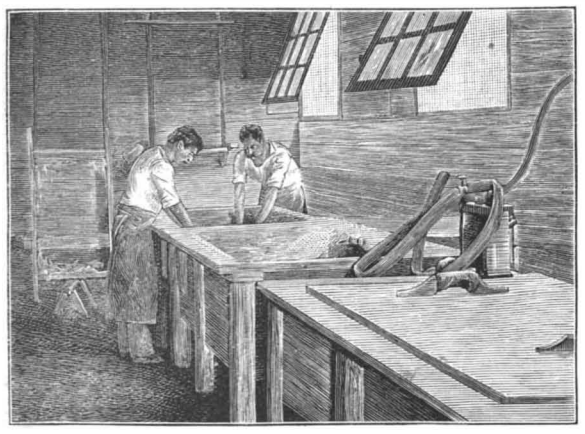


Fig. 3.—KNEADING THE NITRO-GLYCERINE MIXTURE.

and the resounding of the rails under the vault of the great new tunnel of the Alps.

The weather was superb (it was in the beginning of May), and, while admiring the splendid panorama that was unrolling before our eyes, we began an animated conversation, the only one that interested us at this time, upon the chances of success of the colossal enterprise that was then taking its first step.

When will this gigantic, nine mile tunnel be perfected? In nine years, in eight years, or in a greater or less number of years? And we, humble servants of

Fig. 5.—FILLING THE CARTRIDGES BY MACHINE.

the audacious work (a half dozen comrades of us, engineers and employes of the enterprise, had met each other), already foresaw the hour of triumph—the day on which, after proceeding step by step, the last blast, the last explosion of powder, would finally destroy the last obstacle and make the road free between the two as yet virgin sides of the mountain.

That will be hard, said one of us. Think a little, friends. We shall in the first place, before reaching the central rock, meet with more than a mile of granite, and the Gothard granite is not soft, I assure you. And so saying, my old friend Arnaud took from his pocket a piece of rock of a brilliancy and hardness that was not very assuring. Pshaw! have we not dynamite now, carelessly remarked one of the party.

At this word dynamite, a group of travelers that had left Lucerne at the same time that we did, and that our conversation upon the work of constructing the great tunnel must certainly have interested, approached. One of the group, a large and stout fellow, dressed in gray velveteen, and who had all the air of an engineer or a contractor of public works, took part without ceremony in our discussion. But I am bringing you dynamite, said he abruptly, and you will just see how your granite is going to crumble! I believe, upon honor, that while speaking he cast a significant glance at a carefully buckled valise insidiously covered with a Scotch shawl of peaceful aspect, very surely to conceal its belligerent intentions. This valise, as we assured ourselves an hour later in touching glasses at the hotel of the Poste de Fluelen, must have hidden a volcano! The traveler was none other than one of the most enterprising manufacturers of the epoch. The intelligent engineer had got a glimpse of the colossal future in store for dynamite, the new explosive, which was then making but very little noise in the world.

Three months after this meeting, a dynamite manufactory was installed at Isleten, at the foot of the valley of Isenthal, very near Fluelen. It still exists, and the tourists of to-day do not fail to cast a glance at the red roofs of the works from the deck of the boat or from the railway. You are surely going to ask me the name of the traveler with the mysterious and inflammable valise. It was Mr. Barbe, who was afterward, in 1887, in the Rouvier cabinet, and who, as we know, was the soul of the dynamite industry. The friends who accompanied him were Mr. Brüll, who was vice-president of the Society of Civil Engineers; Mr. Vian, now deputy of Seine-et-Oise, and also one of our most active dynamite manufacturers; Mr. Xavier Bender, who was to construct the Isleten works; and Mr. Nobel himself, the inventor of the new explosive.

Dynamite has made its way since those twenty years back. The entire world manufactures; millions upon millions of pounds of it. There is scarcely a civilized country that does not possess its dynamite manufactory. France has three of them, which represent, one with another, four million pounds of dynamite manufactured, say five million cartridges like those that produced the recent and criminal anarchist explosions.

After having acquired a just renown for the exceptional services that it has everywhere rendered in mines, great public works and military science, dynamite has not contented itself with this specific halo of glory; and (it is necessary to say it) its universal reputation did not cross the circle of its special relations until the day when it strayed off in bad company.

Finally, you say, tell us, then, you who have used and manufactured it so long, what dynamite is. How is it manufactured? And who are the beings unfortunate enough to live in the midst of this hell, still more terrible than the legendary one, since one burns therein and is blown up therein, to boot. And, especially, don't perplex us with your formulas and your acids with uncouth names.

Well, my friends, I offer you an exceedingly simple thing. I am going to pass you through the door of the Isleten manufactory that I have just mentioned, in awakening my old, very old recollections of the time when I was still under the orders of Louis Favre, a contractor on the great St. Gothard tunnel, and when my old friend Xavier Bender, now at the head of the French Society of Explosives, directed the manufactory in question. And now, attention! Simply have the extreme obligingness to follow with me, in the order that I shall point out to you, the series of engravings that are herewith reproduced with great fidelity, and that represent the different phases of the manufacture of a dynamite cartridge. It is a good fortune that falls to your lot, curious readers, to be able to consult these engravings, since the entering of a dynamite manufactory, simply to visit it, is not a thing within the reach of all. To carry away photographs thereof is a true miracle, and I do not think I deceive myself when I say that such a publication as this is made for the first time. Do you wish in the first place to admire a remarkable collection of cartridges exactly identical with those that were stolen at the depot of Soisy-sous-Etoiles, and that were found later on, upon the information of Bricou, under the hay of the fortifications, after being concealed in the Garden of Plants? Look, then, at our figure representing the store room wherein the manufactured cartridges are put into cases of 55 pounds each. You have them everywhere. To the right there is a basket full of them, piled up one on top of the other. The women

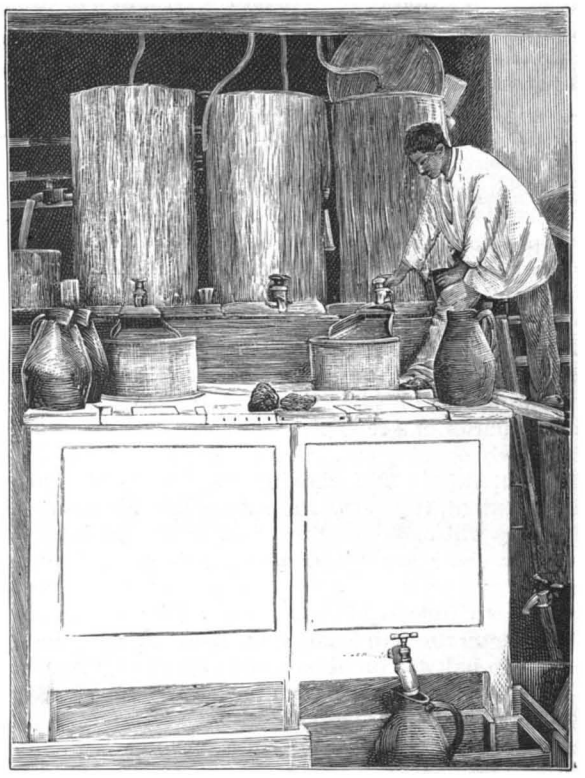


Fig. 2.—COLLECTING THE NITRO-GLYCERINE AS IT COMES FROM THE APPARATUS.

that you see seated pack them in those cardboard boxes covered with tarred paper that encumber the tables. Thirty of them, 5½ pounds in all, are put into each of these boxes. Ten of these boxes are arranged in a case like those that the workmen are screwing up in the foreground. At the rear, the foreman is watching things. The cases afterward go to the magazine, and thence to the railway.

The manufacture of these cartridges is, in the main, very simple. It is necessary to say, in the first place,

Fig. 4.—FILLING THE CARTRIDGES BY HAND.

that before being put into cartridges, the dynamite is in the form of a powder—not a dry, hard, and crystallized powder, like the article for sporting purposes, but in an oily form, easily crushing under the finger. It could not be better compared than to the cocoa powder with which housewives manufacture the fragrant chocolate of the morning meal. I shall tell you presently how this powder is made. I cannot explain it all at once, especially since you have imposed upon me

Fig. 6.—FINAL CLOSING OF THE CARTRIDGES.

clearness and simplicity—two conditions that are very difficult to fulfill here.

Here, then, is our dynamite powder in a receptacle called a "vasque." It is carried to special rooms where the women shown in our various figures calibrate it by hand or with a machine. If they work by hand, they content themselves (as may be seen in Fig. 4) with ramming the oily powder, by means of a wooden rod, into moulds fixed to the bottom of a zinc pan. After the powder is calibrated, it is covered with paper and is ready to be packed.

More curious and much more employed is the mechanical method. Two of our engravings show a group

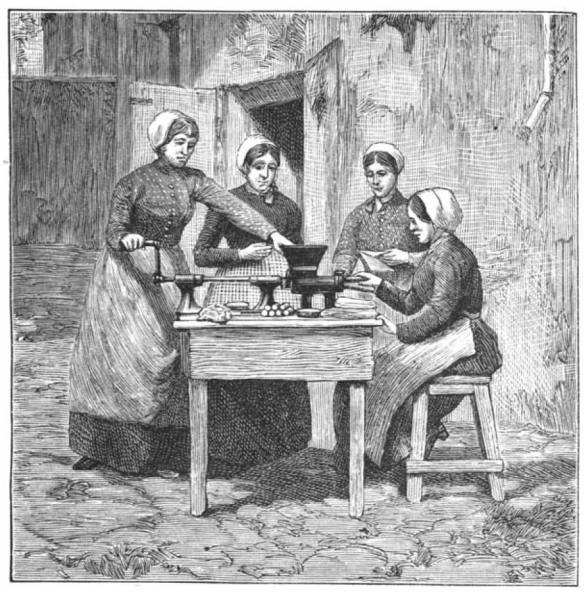


Fig. 7.—FILLING CARTRIDGES WITH EXPLOSIVE GUM.

of women, "cartouchieres" as they are called in the works, occupied in the manufacture of cartridges of the terrible substance. The machine, which is screwed to a wall, is of the most rudimentary description. A lever, maneuvered by the woman to the right, gives a to and fro, upward and downward motion to a bronze rod (everything is of bronze and not of iron here, in order to prevent rapid heating through friction), and compresses into a cylinder of definite caliber (from 8-10 of an inch to 1 inch) the dynamite powder contained in a leather funnel that is shown in the figure. The woman to the left breaks the roll of calibrated dynamite when she finds it of sufficient length (2¾ to 3¼ inches), and passes it to the cartridge maker situated in the center, who covers it with parchment paper in order to protect it from dampness. The cartridge is then entirely finished. Fig. 6 represents the operatives grouped around the same machine, and occupied in the final closing of the wrapped cartridges. Fig. 7 shows the filling of cartridges of the same length and diameter with what is called "explosive gum," which is composed exclusively of pure nitro-glycerine and nitrated cotton, forming a plastic paste of gum whose high explosive power is utilized for crushing the hardest rocks and for submarine blasting.

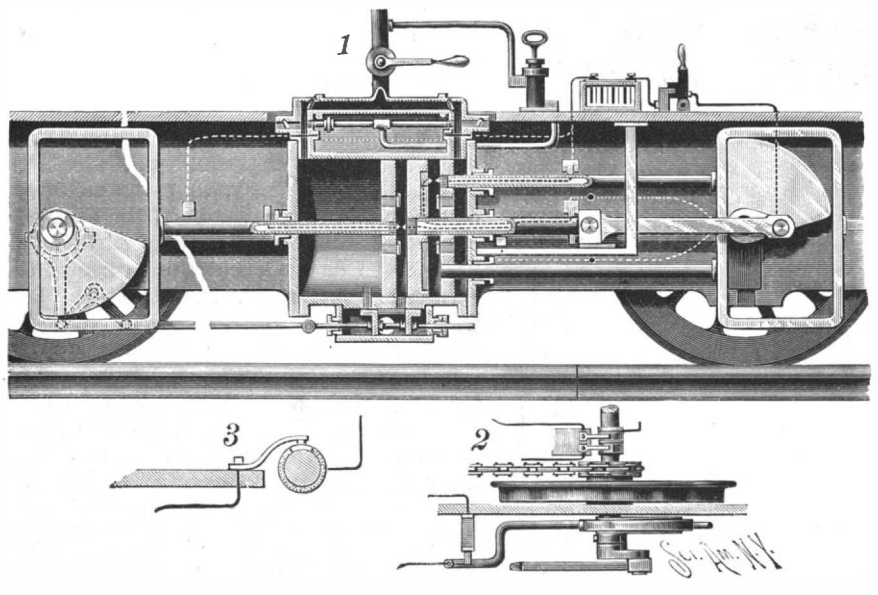
This machine might well be compared to the one used for making sausages. The gummy explosive material is accumulated in the hopper to the right. The winch to the left is turned, and the cartridges make their exit in pairs from the cylinders to the extreme right. Between the bottom of the hopper and these cylinders there is a bronze spiral that carries the substance forward and causes it to direct itself out of the machine. An operative receives the cartridges upon their exit, wraps them in paper and closes the two extremities. These cartridges are afterward carried to the packing room and put into cases, as we have already said.

It now remains for me to tell you the composition of the famous nitro-glycerine, which, up the present, seems to be, as it is in fact, the explosive constituent of what is called dynamite (from the Greek δυναμις, power). If you will refer to our engravings, you will find very faithfully represented therein the industrial manufacture of this mysterious nitro-glycerine.

The huge cylinder (which is of lead) that you see in our first figure contains the terrible mixture of nitric and sulphuric acids and glycerine, the chemical reacrion of which forms nitro-glycerine. The array of pipes that end at the cylinder, or empty themselves at the top, are the ones that lead each of these constituents to the interior of the apparatus, or that conduct the water designed to cool the mixture in order to prevent explosions due to ill-timed elevations of the temperature. In Fig. 2, a workman is placidly collecting the oily and explosive liquid, a glassful of which would suffice to blow him to atoms. This valuable and sometimes criminal liquid is carried to the room represented in Fig. 3, where it is mixed with a silicious powder. It is then kneaded until the nitro-glycerine is absorbed by the powder. . . . The paste thus formed is that which we have just seen put into cartridges, which are afterward sent to the magazines, whence they are shipped to the industries.—*Maxime Vuillaume, in L'Illustration.*

AN IMPROVED GAS ENGINE.

This engine has a double-acting piston adapted to take in the combustible mixture and compress it on either side of the power piston, there being an electric ignitor for igniting the combustible charge. The improvement has been patented by Mr. John S. Biggar, Whitesborough, Cal. Fig. 1 is a side sectional elevation, Fig. 2 shows a plan view of a portion of the engine, and Fig. 3 shows one of the contact springs. On opposite sides of the power piston are pistons drawing in the combustible mixture, one such piston being connected by a tubular piston rod with a rectangular frame acted on by a quadrant cam on one of the drive wheel axles, while the other piston has two piston rods, one of which is tubular, the rods passing through stuffing boxes in the cylinder head, and being connected with a rectangular frame which incloses a quadrant cam secured to the other drive wheel axle. At the top of the cylinder is a valve chest, with gas and air passages, and a gas pump, and in the under side of the cylinder are ports covered by a valve chest in which is a double exhaust valve to open and close the ports alternately, the rod of the valve being connected with an eccentric rod embracing the eccentric on one of the drive wheel axles. On the frame of the engine is located a battery, one pole of which is connected with contact plates, while the other pole is connected with a switch. When it is desired to start the engine from a state of rest, gas is drawn by the pump from the supply pipe and forced into the cylinder, already containing sufficient air to form an explosive mixture, and the charge is ignited by the automatic making and breaking of electrical contacts. The charge having been exploded, and the power piston forced to the extremity of its stroke, the auxiliary piston is made to follow it by the quadrant cam on one of the drive wheel axles, thereby drawing in the combustible mixture, which is thus compressed before explosion, the operations proceeding alternately on opposite sides of the piston. To cause the axles of the drive wheels to rotate together, they are connected by an endless chain running over sprocket wheels on the axles.



BIGGAR'S GAS LOCOMOTIVE.

Candy Without Cooking.

To make a delicious candy, break the white of one egg into a large, flat dish. In one end of the dish put about one pound of the very best confectioners' sugar, carefully sifted. Beat the egg, taking up a little of the sugar at a time and beating steadily for about ten minutes. Before all the sugar is in add a large teaspoonful of some preferred extract, vanilla, lemon, or rose, the first being most generally liked. Beat or stir until the sugar is all in. When done it should stand up in a firm lump and should settle but very little if left standing. Then dust a little fine sugar on a pastry board, cut off with a sharp knife a part of the beaten sugar, lay it on the board and roll it under the hands until perfectly soft and smooth, then make into a roll about as large as a 25 cent silver piece, cut off little round cakes of this about half an inch thick, pat this between the hands until very smooth, then place the half of an English walnut on the prepared pat of sugar and press it a little to bring the two in close contact. Have ready a plate rubbed over with a bit of buttered paper. On this place the candies as fast as made.

They may be set in the oven for a minute or on a shelf above the fire. Many persons put them on buttered paper, but they sometimes stick and tear the paper which adheres to them, and which is objectionable when the confection is eaten.

Sugar prepared in this way may be used to coat fruit or nut confections of various sorts. Blanched almonds are rolled in little cakes of it, care being taken to press and roll the sugar so that the nut is entirely covered. Various sorts of nuts chopped fine may be mixed in with the sugar or fruits, such as citron shredded, seeded raisins cut up fine or candied, or preserved fruits of any sort, care being taken that they are not too juicy, as this would prevent hardening.

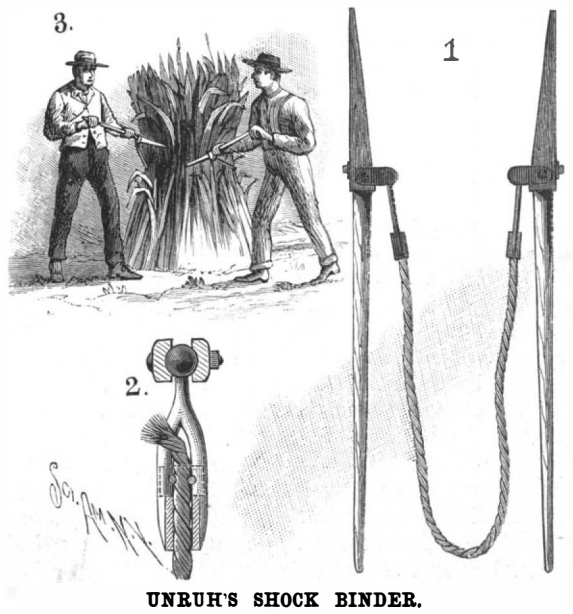
Fresh fruits may be put up in this way. If grapes are dipped in the beaten white of an egg and allowed

Fig. 8.—PACKING AND BOXING THE CARTRIDGES.

to dry, then rolled in this same beaten sugar, they are delicious. Sometimes the confection is made quite soft, then placed in a hot oven for a moment and allowed to remain until thoroughly scalded through, care being taken that it is not browned. In this way it gets the elastic, firm quality so much liked in what are called French confections.—*N. Y. Ledger.*

AN IMPROVED SHOCK BINDER.

The device shown in the illustration is designed to facilitate the binding of corn shocks quickly and tightly, in order that they may be readily tied. It has been patented by Mr. Charles S. Unruh, of Steele City, Neb. As shown in Fig. 1, two levers are employed, a socket being fastened by a bolt on the inner face of each lever, and each socket having a circular recess to receive a ball formed on the shank of a clip, as shown in Fig. 2. The body of the clip is tubular, and immediately above the body of the clip each side face of the shank is engaged by a tie plate, the two tie plates being connected by bolts, provided with suitable nuts. The binding section of the device consists of a rope whose ends are passed through the tubular bodies of the clips, where they are held by tightening the tie plates. When the device is operated by two men, each engages the lever with one side of the shock, and draws the rope around, as shown in Fig. 3, the shock being tied by means of binding twine, after the stalks have been drawn as closely together as possible. The device may, however, be operated by one man, the ball and socket connection between the clips and the levers permitting the latter to be carried in almost any direction without twisting or unduly kinking the rope.



UNRUH'S SHOCK BINDER.

THE auger that bores a square hole consists of a screw auger in a square tube, the corners of which are sharpened from within, and as the auger advances, pressure on the tube cuts the round hole square.

How to Cure a Cold.

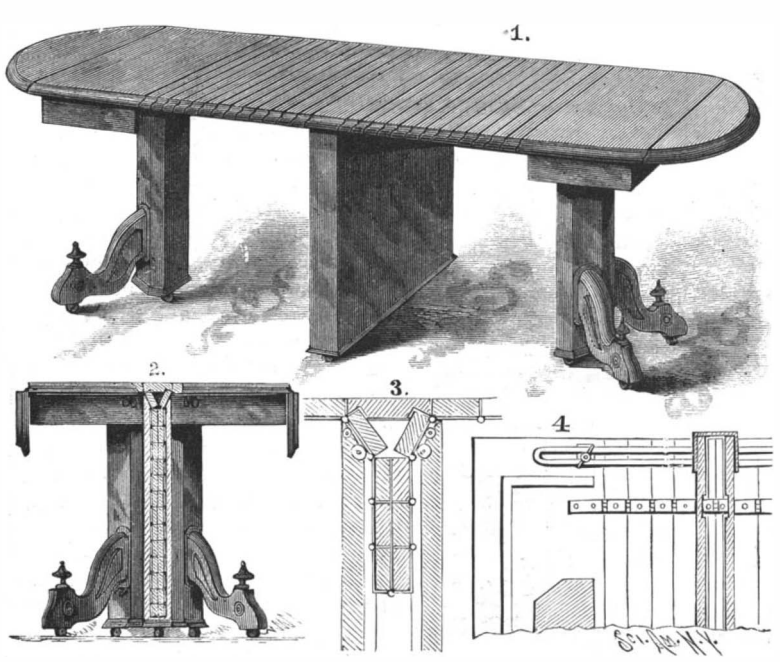
Almost everybody has a remedy for a cold, which he is ever ready to recommend to others after detailing his own experience.

The Boston *Journal of Commerce* quotes from a medical writer some advice on this subject which seems to be more than ordinarily useful.

When one becomes chilled, or takes cold, the mouths of myriads of little sweat glands are suddenly closed, and the impurities which should pass off through the skin are forced back at the interior of the body, vitiating the blood and putting extra work on the lungs and other internal organs. Just beneath the surface of the skin, all over the body, there is a network of minute blood vessels, finer than the finest lace. When one is chilled, the blood is forced from these capillary vessels into one or more of the internal organs, producing inflammation or congestion, and thus often causing diseases dangerous to life. The time to treat a cold is at the earliest possible moment after you have taken it. And your prime object should be to restore the perspiration and the capillary circulation. As soon, then, as you feel that you have taken cold have a good fire in your bedroom. Put your feet into hot water as hot as can be borne, and containing a tablespoonful of mustard. Have it in a vessel so deep that the water will come up well toward the knees. Throw a blanket over the whole to prevent rapid evaporation and cooling. In from five to ten minutes take the feet out, wipe them dry, and get into a bed on which there are two extra blankets. Just before or after getting into bed drink a large glass of lemonade as hot as possible, or a glass of hot water containing a teaspoonful of cream of tartar, with a little sugar if desired. Should there be a pain in the chest, side or back, indicating pleurisy or pneumonia, dip a small towel in cold water and wring it as dry as possible. Fold the towel so that it will cover a little more surface than is affected by the pain. Cover this with a piece of flannel, and both with oiled silk, or better, with oiled linen; now wind a strip of flannel a foot wide several times around the chest. The heat of the body will warm the towel almost immediately, the oiled linen and flannel will retain the heat and moisture, and, steaming the part, will generally cause the pain to disappear. Should there be pain or soreness in the throat, you should treat in a similar manner with wet compress and flannel bandage. Eat sparingly of plain, simple food. Baked apples and other fruit, bread and butter, bread and milk, milk toast, baked potatoes or raw oysters may be eaten. By following the above directions intelligently and faithfully you will ordinarily check the progress of the cold, and prevent serious, possibly fatal, illness.

AN IMPROVED EXTENSION TABLE.

The table shown in the illustration has been patented by Julius S. Graaff and I. M. Harbaugh, of Portland, Oregon, and the improvement has also been patented in Great Britain, France, and Germany. The rigid end sections of the table top are connected by narrow hinged leaves, forming a continuous hinge, or the leaves may be held together by rubber bands, belting, or other suitable material and these leaves are adapted to double down in a box, cabinet or skeleton frame at the center of the table as shown in Figs. 2 and 3. The box is provided with vertical side recesses to receive the hinges, and with anti-friction rollers, enabling the leaves to be easily moved. At opposite sides of the box, near the top, are angle braces, the upper arms of which extend outwardly beneath the table top, giving a full and substantial support thereto, and slide within the rigid portions at the ends when the table is closed, as shown in Fig. 2. As shown in the partial view of the under side of the table top, Fig. 4, the arms of said braces are slotted, and adapted to be engaged by thumb screws turning in nuts in the rigid end portions of the table, the screws being tightened to hold the parts in fixed position, either open or closed. The space between the opposite leaves when they dip down into the box is closed by a cover strip having recesses on its under side to fit over the tilting upper leaves, as shown in Figs. 1, 2, and 3. By attaching extra boxes, cabinets, or frames for the reception of additional hinged leaves, the length of the table may be still further extended, and the improvement may be readily applied to an ordinary table. When the table is to be used where space is limited, the box may be attached to the wall and connected with one end portion of a table, which is then extended from the wall by simply pulling it out into the room, the table in its closed position being convenient for use as a desk, shelf, etc. The leaves sliding in the box may also be arranged in independent series, the opposite sides not being hinged together, and with this arrangement one end of the table may be drawn out without disturbing the other end. Simplicity and cheapness, as well as novelty, ornament, portability, strength, and lightness of construction are claimed for this improvement. All correspondence relative to the same should be addressed to Graaff & Harbaugh, 203 Morrison Street, Portland, Oregon.



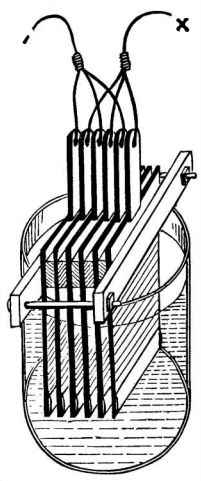
GRAAFF & HARBAUGH'S AUTOMATIC EXTENSION TABLE.

STORAGE CELLS FOR AMATEURS.

C. L. WOOLLEY.

In the construction of storage cells on a small scale, the method of using uncoated lead plates merely roughened, afterward depending upon the forming process to create active material on the surface, gives good results, save that the forming process is exceedingly tedious.

Plates coated with a paste of red lead give better results and that in a very much shorter time. The amateur, however, is usually beset by many difficulties in the matter of the coating of the plates, the paste, no matter how well dried, having a tendency to fall off so soon as the plates are immersed in the acid solution in the cells. The writer has, by means of a simple process which he has already touched upon in a letter on storage batteries, published in the SCIENTIFIC AMERICAN a year or more ago, succeeded in preparing storage cells that have given for various experimental and domestic purposes exceedingly good results, during a period of a year or more, and are still in use. The plates, of any convenient size, may be either cast in wooden or iron moulds or cut from sheet lead; they should be sufficiently thick—⅛ inch or more—to withstand possible bending or buckling as much as possible. A strip of sheet lead 4 or 5 inches long should be soldered to the top of each plate, from the upper end of which soldered copper connections may proceed. The copper is thus removed from the danger of corrosion from acid spray. Holes having a diameter of about one-half inch should be punched in each plate at regular intervals. The balance of both sides of each plate should be thoroughly roughened, either by drawing the tang of a file repeatedly across in various directions or by the use of a punch with a roughened face. For coating the plates a stiff paste should be mixed of powdered red lead made up with a mixture of water 2 parts, sulphuric acid 1 part. The plates are to be thoroughly coated on both sides, and the holes in the plates well filled up. Each plate is then, while paste is moist, wrapped tightly in one or two layers of coarse muslin, and this is bound down firmly in place with cotton cord, passing around the plates at short intervals. The use of the cloth coverings makes success possible. The paste is held in position until, by the process of forming in the cells, it becomes sufficiently hard and adherent to remain in position on the plates, when, if they have not already been rotted off by the acid, the cloths may be removed.



STORAGE CELLS FOR AMATEURS.

The number of plates in a cell may be from a single pair to an indefinite number. Connections are made to alternate plates, one connection proceeding to plates Nos. 1, 3, 5, 7, etc., the other connection to plates Nos. 2, 4, 6, 8, etc.

When not more than six or eight plates in each cell are used, a convenient method of holding them in place is shown above. A series of wooden insulating strips are made, each being thoroughly baked and soaked in hot paraffine. Two heavier wooden bars on either side of the row of plates, drawn together at the ends by bolts, serve to hold the plates in position, each plate being separated from the one next to it by one of the insulating strips. The wooden bars should also be well soaked in paraffine. The bars are of such length that they extend across the top of the cell and sustain the row of plates and prevent their touching the bottom of the cell. A single cell when charged will give two volts. Each additional cell arranged in *series* will add 2 volts, as 4, 6, 8, etc. The charging current may be from a small dynamo or a primary battery, in which case a gravity or blue vitriol is to be preferred.

The E. M. F. of charging current must exceed the sum of the storage cells by at least 10 per cent. For example, three cells gravity will charge a single cell of storage, five or six will charge two cells storage, eight or nine will charge three cells of storage, and so on.

The storage cells may be used very satisfactorily for operating small lamps, small fan or sewing machine motors, etc.

The first charging of a new storage cell is best accomplished by a series of bichromate cells, as Fuller or carbon, after which the gravities will charge very well. It will be found that up to a certain point the capacity of the storage cells will increase with each charge and discharge. The solution in the cells in which the plates are immersed is composed of water, 9 parts, sulphuric acid (commercial), 1 part. After forming, always charge in the same direction and always discharge the cells through some form of resistance.

Solidified Chloroform.

A new discovery is described in the *Berichte* which is likely to throw some light upon the vexed and important question of chloroform and its impurities. Professor Anschutz, of Bonn, in the course of certain researches in which the preparation of salicylic anhydride ($C_6H_4CO_2$) was involved, had occasion to use chloroform in the process, when he found that the mixed solution after being left for some time deposited in beautiful crystalline form a compound of chloroform with salicylic anhydride. A similar compound is formed also when ortho-cresotinic acid is substituted for the salicylide. The salicylide contains about 33 per cent of chloroform and the cresotinic compound about 30 per cent. Both bodies yield very pure chloroform when heated to 100° C.—a temperature considerably below their melting points. The cresotinic compound is, however, the more stable body, decomposing but little in the air, while the salicylide, under the same conditions, slowly gives off chloroform in a state of remarkable purity. Inasmuch as none of the usual impurities of chloroform crystallize along with these compounds, the process would appear to afford a method for the purification of chloroform on more satisfactory lines, for repeated crystallization is a method which yields, as every chemist knows, the purest and most refined products. Moreover, a solid chloroform compound is, as will be imagined, less likely to undergo decomposition than a liquid compound, while the advantage of being able to transport chloroform practically in a solid form (for by simply warming the compound pure chloroform may be obtained) is one of obvious value. Meanwhile, the results of clinical experiment with this new product will be awaited with eager interest—this being the test that alone can decide its value for anæsthetic purposes, however "chemically pure" the substance may be.—*Lancet.*

Oil vs. Coal.

The question of whether an oil operator has a right to drill through coal which has been leased previously, to reach oil or gas below, is one which has been the basis of a number of suits, and the lower courts in this State have decided that the owner of the surface has such right. The Chartiers Block Coal Company determined to test the decision and carried its case to the Supreme Court of Pennsylvania. Chief Justice Paxson has handed down his decision in the case, sustaining the finding of the lower court. Judge Paxson reviews the case, and after stating that the rights of the oil operator to reach his possessions are inalienable, says: "The grantee of the coal owns the coal but nothing else, save the right of access to it and right to take it away. When the coal is all removed the estate ends and the space it occupied reverts to grantor by operation of law. The owner of the coal must so enjoy his own rights as not to interfere with the lawful exercise of the rights of others, who may own the estate either above or below him. The surface owner has a right to reach his estate below the coal at all times. If we sustain the company, it will leave the owner of the surface at the absolute mercy of the owners of the coal. For these reasons we will not disturb the decree of the court below. The appellant company has its remedy at law, and to that we will remit it. The decree is affirmed, and the appeal dismissed at the cost of appellant."

A MONSTER LOCOMOTIVE.

We illustrate on our first page this week the new monster locomotive of the Mexican Central Railway, designed by Mr. F. W. Johnstone, superintendent of motive power of that railway, and built by the Rhode Island Locomotive Works. This is probably the largest and most powerful locomotive engine now extant. It has been built for special service in drawing freight trains over the heavy grades and curves between Tampico and the city of Mexico. Some of the grades are 158·4 feet to the mile and curves 18 to 22°. The weight of this great machine is 130 tons. In exterior appearance it looks like a couple of locomotives of the mogul pattern backed up together, with the two cabs joined. Flexibility sufficient to go round the sharp curves with least frictional resistance is gained by securing the driving wheels in a truck which is free to move in a line different from that followed by the main frames.

The cylinders and boilers are carried on the main frames separate from the driving wheel truck. As the cylinders are not in line with the driving wheels in rounding curves, it is necessary that a special method of transmitting power from the cylinders to the crank pins should be employed. This is done in a very ingenious way through levers that transmit the power and compensate for the varying distances between the pistons and the crank, due to the swiveling of the driving wheels. But for this compensating arrangement, it would be necessary to give the engine so much cylinder clearance that the loss of steam would be very great. The power-transmitting levers are at the back of the cylinders, connected at the top by a short link, and the bottom ends pinned to the front end of the main rods. There are two of the latter, one connecting with a crank pin, the other with a return crank. The piston transmits motion to the back one of the two levers, and that gives motion to the front lever, which is fulcrumed securely to the frame near its center.

The engines are compound, with annular cylinders, the high pressure cylinder being in the middle and the low pressure cylinder outside. The high pressure cylinder is 13 inches diameter and the low pressure 28 inches. The stroke is 24 inches. It is calculated that the cylinder capacity of each pair of cylinders is equal to a 19 by 24 simple engine.

The boilers are of Otis steel, 9-16 inch in diameter, and carry 180 pounds of steam to the square inch. They are 54¼ inches in diameter and have 201 two-inch tubes, 15 feet 9⅛ inches long. The fireboxes are of the Belpaire type, 56 inches long and 56 inches wide.

The arrangement of working is that the valve motion of the two engines is operated by one screw reverse lever.

In the new locomotive the engineer sits on one side of the cab with all the necessary apparatus for working the double-ender within easy reach. On the other side the fireman pours in the fuel through side doors. A coal passer is necessary to aid him.

Safety of Steamboat Travel.

The efficiency of the existing steamboat inspection laws is well illustrated in the following extract from the recent report of the inspector-general:

The present steamboat laws went into operation February 28, 1871; and, therefore, with the beginning of the present year, they have stood the test of twenty-one years.

During that time the number of steamers inspected has increased from 3,102 inspected in 1870, under the law of 1852, with a total tonnage for that year of 942,272 gross tons, to 7,661 steamers inspected during the fiscal year ending June 30, 1892, with a total tonnage of 2,000,553·37 gross tons.

During the nineteen years of the operation of the law of 1852 there were 1,504 disasters to steam vessels, with a loss of 9,320 lives, or an average per annum of 490 lives lost caused by such disasters.

Whereas, notwithstanding the great increase in the number of vessels since 1870—over 100 per cent—there have been but 729 disasters to steam vessels, with a loss of but 5,057 lives, or an average of 240 per annum; the number of passengers carried per annum having increased from 122,589,130 carried in 1870 to not less than 650,000,000 carried in 1892. The average loss of life under the law of 1852, as obtained by dividing the number of passengers carried in 1870 by the average (490) number of lives lost for those years, was one person to every 250,181 passengers carried; while under the operation of the law of 1871 an average obtained by dividing the number of passengers carried in 1892 by the average (240) number of lives lost in the years covered by the latter law gives only one life lost in each 2,708,333 passengers carried, or a reduction in the number of lives lost of nearly 11 to 1 in proportion to the number of passengers carried.

These results show that under the present steamboat laws, travel by steamboat is safer than by railroad or any other vehicular mode of travel—in fact, safer than is pedestrian travel in large cities.

The number of railway passengers carried last year was 530,000,000, of whom 293 were killed.

Correspondence.

The Elliptical Sprocket Wheel.

To the Editor of the Scientific American:

Will some one who is conversant with the advantages claimed for the elliptical sprocket wheel in bicycles, of which so much is said of late, kindly oblige a reader of the SCIENTIFIC AMERICAN by explaining in detail just what those advantages are? Some claim an advantage of ten per cent in power, but fail to give the philosophy on which this claim is based.

EDW. J. PRINDLE.

Torrington, Ct., February 13, 1893.

[The only advantage we can see is in the increase of power that may be put on the crank by the weight of the rider in its horizontal position, at which moment an extension of the diameter of the sprocket driver is made by the vertical position of its longest elliptic axis—increasing as it does from its horizontal position to the vertical, and decreasing to the horizontal, twice during a revolution. There is no absolute mechanical gain during an entire revolution of the elliptic drivers, by virtue of their ellipticity, but the advantage lies in the facility of economizing the value of the foot tread at the best points in the revolution of the sprocket ellipse by enlarging its radius at the moment of greatest foot pressure.—EDITOR.]

Virginia at the World's Fair.

To the Editor of the Scientific American:

I notice in your issue of February 18, in speaking of the World's Columbian Exposition, and giving foreign and State appropriations, you have left out the State of Virginia entirely in your tables. This State made an appropriation, through her legislature, of $25,000, which was approved March 4, 1892, nearly a year ago, for the purpose of being represented in Chicago at the World's Columbian Exposition. She also authorized counties and cities to make such appropriations as they might deem proper. The governor appointed a State board and also an auxiliary board from every county and city in the commonwealth. These boards have been actively at work, and the appropriation from the State and these other sources aggregates over $50,000. They have constructed a building on the grounds of the World's Exposition at Chicago which is a reproduction of Mount Vernon, both as to the construction of the building exterior and interior, and also a reproduction of all the furniture, or the use of similar furniture, which has been tendered by descendants of the Washington family and others of the colonial period. This Virginia building, on account of its historic association, will probably be one of the most interesting State buildings on the Exposition grounds, and will be visited by more people, both foreign and from this country, than any other State building.

V. D. GRONER,
United States Commissioner from Virginia.

Norfolk, Va., February 17, 1893.

The Snow Shoe.

To the Editor of the Scientific American:

The article in the SCIENTIFIC AMERICAN for February 4 on "Snow Shoe Exercise in the German Army," taken from *L'Illustration*, is, as regards description of the snow shoe, very faulty compared with the very excellent illustration accompanying the same. For the benefit of your many readers to whom a snow shoe of the kind referred to is a novelty, let me describe one:

A strip of any kind of close-grained wood, about 3½ inches wide (tapering slightly backward), 6 to 9 feet long, 1¼ inches thick at center, tapering to about ⅜ of an inch at ends. From end to end it is turned sufficiently to give a spring of about an inch, and the surface is slightly concave or furnished with a shallow longitudinal groove in center. The front is curved upward like a sleigh runner. Slightly back of the balancing point a toe band is adjusted, through a transverse opening in the snow shoe. This, with another band passing around the heel, is the only fastening used. Norway may be said to be the home of the snow shoe (*ski*), and such is the kind used—the shorter for speed and jumping, the longer for service. Ingredients to make the surface smooth and hard are used, but they are never shod with iron, as stated in the article. Lightness is an advantage sought. While it is true that snow shoes have been used in military operations, as stated, for centuries back in Northern Europe, the hunters never attempt to pursue the boar on them with any hope of dispatching it with a stick. It is, however, true that the Finns sometimes run down a troublesome wolf when the snow is deep and loose, but it is always a question of endurance rather than speed.

J. C. NORBY.

Ada, Minn., February 9, 1893.

Association of Inventors and Manufacturers.

The second annual convention of the American Association of Inventors and Manufacturers was lately held in Washington, Dr. R. J. Gatling, the inventor of the Gatling gun, presiding, with a large number of members in attendance. Papers were read by members of the association as follows: Mr. Arthur Stewart, of Baltimore, on the distinction between the patent system of the United States and those of other countries; Mr. Wm. C. Dodge, of Washington, on the benefits of the United States patent system; Mr. Oberlin Smith on a proposed Patent Office department of standards; Mr. Stephen H. Emmons on inaccuracies in the metric system of measurement; Mr. A. T. Andrews, of Connecticut, on the rights of inventors.

Among the business transacted was the adoption of resolutions asking of Congress such legislation as will perpetuate and perfect the American patent system, and the use of so much of the funds paid by the inventors as may be necessary to provide the Patent Office with the room, force, means, and appliances necessary for the proper and prompt transaction of the business intrusted to it, and also to provide a special court for the trial of patent causes, to the end that speedy and uniform decisions may be had with a minimum of litigation, delay, and expense.

A committee was appointed to select a committee of representative inventors and manufacturers from the different States to constitute an inventors' congress, to be held some time during the World's Fair. A committee on subjects and publications, consisting of James T. Dubois, Washington; Octave Chanute, Chicago, Ill.; Irving Elting, Poughkeepsie, N. Y.; Elihu Thomson, Lynn, Mass.; and George N. Bierce, Dayton, O., was also appointed.

The Weight a Man can Handle in Ten Hours.

I was past 22 years of age when I hired with a Mr. Grimes, the boss of the Manchester Machine Company. I was to work in the yard as laborer until a better opportunity offered, which did come when I went into the machine shop. There arrived by rail some 500 tons of pig iron, which was hauled from the cars on dump carts and dumped in the yard and piled up in rows about four feet high. The pigs weighed from say 60 to 150 pounds each. A man of the name of Bunting did the hauling, and each load was weighed on the scales as it came into the yard. One day's hauling had been done and piled up by four of us yard hands. In the morning Grimes said to me that a lot of machinery had arrived for the print works then being built, and that he would have to take all of the yard hands except me, so that I might pile up what I could and let the balance lie on the ground. We used leather pads on our hands to protect them from wear and soreness in handling the iron, which is always rough. I took into my mind the idea of piling up all that was hauled that day, just to see what could be done.

Mr. Bunting drove one of his teams. They hauled about one ton at a load. Every time he came in he would laugh at me, supposing that I could pile it all up as fast as it came in, and said: "Young man, we'll make you weaken before night." I considered this a sort of challenge and accepted it, and just as the whistle blew to quit work I had the last pig on the pile, about as used up a man as ever lived at the end of ten hours' work. Bunting and myself went into the office and had the clerk foot up the weight, which was 212½ tons.

I was so used up that I could scarcely walk to my boarding house. I retired early and had a good night's sleep, and was so stiff that I could scarcely get down stairs. I hobbled down to the yard office, when Mr. Grimes looked at me and said: "Emerson, what possessed you to pile up all that pig iron yesterday, you foolish fellow? Now you go home and rest, and your wages will go right on for two days, for you did more than three good days' work." I confess that I was pleased with the opportunity, but only lay off one day, and when I went to work it was to pile up a few cords of wood, and I shall never forget how light it felt. It seemed as though I was handling cork. I don't think that it ever injured me; but would not advise any man to try such a feat. J. E. EMERSON.

Bananas and Potatoes.

The banana and the potato disclose through chemical analysis that they are almost identical in composition, as witness the following comparison:

	Banana.	Potato.
Water	75·71	75·77
Albuminoids	1·71	1·79
Total carbonaceous matter (non-nitrogenous)	20·13	20·72
Woody fiber	1·74	0·75
Ash	0·71	0·97

W. M. Doherty deduces from these figures the fact that, so far from the banana being a perfect food for man, as is frequently claimed, the small quantity of albuminoids present indicates it as being insufficiently nutritious. The average man, under normal conditions, requires 4·2 ounces of flesh-forming substances daily, to obtain which he would need to eat fifteen pounds of the fruit, and this would contain nine pints of water. It is, therefore, a very unevenly balanced food, which is not suited alone for man's diet, but is an excellent and wholesome addition to a diet rich in nitrogenous substances.—*American Analyst.*

Whether suited for man's diet or not, it is pretty certain that many thousands of people in this world subsist mainly on bananas.

RAISING THE FLAG ON THE STEAMSHIP NEW YORK.

Under the existing shipping laws of the United States certain privileges are granted to vessels built in the United States which are denied to ships of foreign construction. The protection of the flag and employment in the coast trade are among the rights which home-built vessels enjoy. As a further encouragement to home shipbuilding industries, Congress has provided for the payment of bounties for carrying the mails, and under this law several fine ocean steamers are now being constructed.

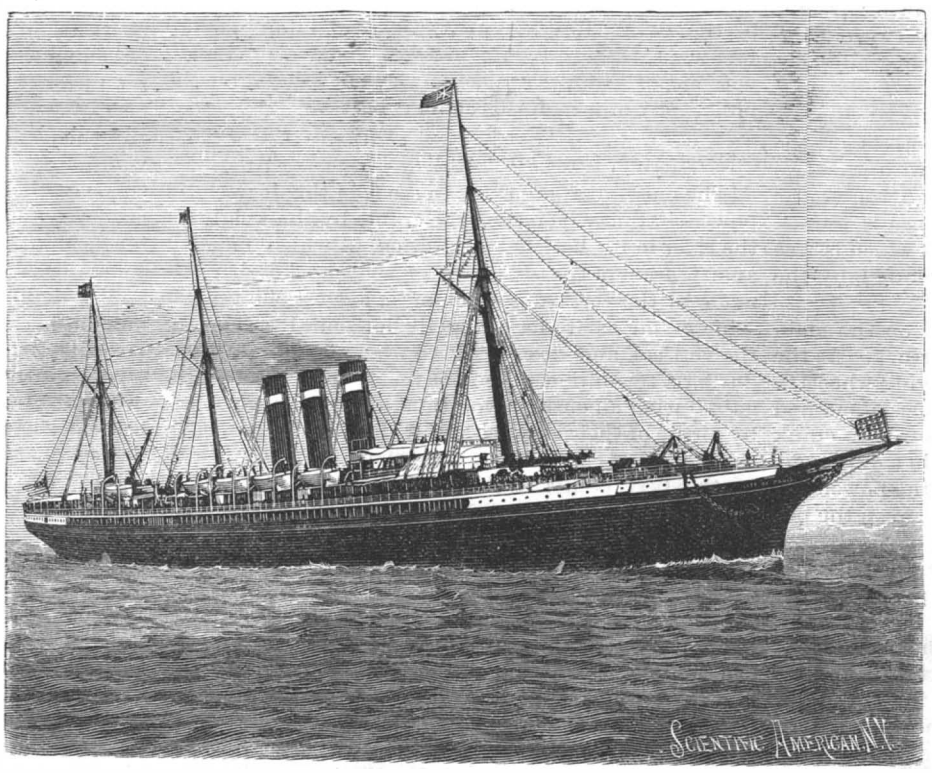
Among the most enterprising steamer companies of this country is the International Navigation Company, of Philadelphia, which operates the Red Star Line of steamships as well as the old Inman, now the American Line. It began service in a modest way between Philadelphia and Antwerp in 1871, afterward establishing a terminus at New York. In 1886 it bought out the Inman Line and constructed the great steamers the City of New York and the City of Paris. Although owned by an American company it was necessary to build them in England and to run them under the English flag, and they have been thus operated for the past two years.

It had been from the first the aim and ambition of the company to have an American line, under an American flag, operated by Americans, and owned by American capital. It was not until two years ago, however, that the way was opened by the passage of the new law giving bounties as stated. The company then set about the building of a fleet of new steamers, and made effort to obtain, by special act of Congress, naturalization papers for the two great vessels already built by them.

In May, 1892, Mr. Cockran introduced in the House and Mr. Frye in the Senate a bill intended to bring it about. It authorized and directed the Secretary of the Treasury to grant registers as vessels of the United States to such foreign-built ships engaged in freight and passenger business and sailing in an established line from a port in the United States as were of a tonnage of not less than 8,000 tons and capable of a speed of not less than twenty miles an hour, and of which not less than 90 per cent of the shares of the foreign corporation was owned by citizens of the United States.

A provision of this bill required the owners to build in American shipyards steamships of an aggregate tonnage of not less than that of the steamships admitted to registry. Both houses promptly passed the bill and President Harrison signed it.

Immediately upon the passage of the act the company opened negotiations with the Cramps. These negotiations culminated within the last few weeks in the signing of contracts for two ocean steamships, to be slightly larger than the New York and Paris, capable of a speed of twenty knots, constructed with transverse watertight bulkheads, making these ships as absolutely unsinkable as are the Paris and New York, and fitted up with every device for safety, luxury and comfort. Five more ships are also to be constructed, all of them larger than the present ships, thus adding 55,000 tons to American ocean steamships of the first order. The aggregate cost of the fleet will then reach $14,000,000.



THE STEAMER NEW YORK, OF THE AMERICAN LINE.

The ceremony of naturalization by raising the American flag on these boats took place in New York on Washington's Birthday, February 22, 1893, and was an occasion of much interest. One of these ships, the New York, gayly dressed in bunting, steamed out from her pier and anchored near the Statue of Liberty, where she was joined by the war ship Chicago and a great fleet of other vessels of all sizes and classes. At 2:30 P. M. the booming of the great guns of the Chicago announced the approach of the steamer from the Jersey shore conveying the President of the United States, who had come from Washington to raise the flag. He was received on board the New York by a large company of distinguished citizens, and after a few formal preliminaries and the deliverance of a very happy address by the Hon. Mr. Cockran, the President approached the halyards and responded as follows:

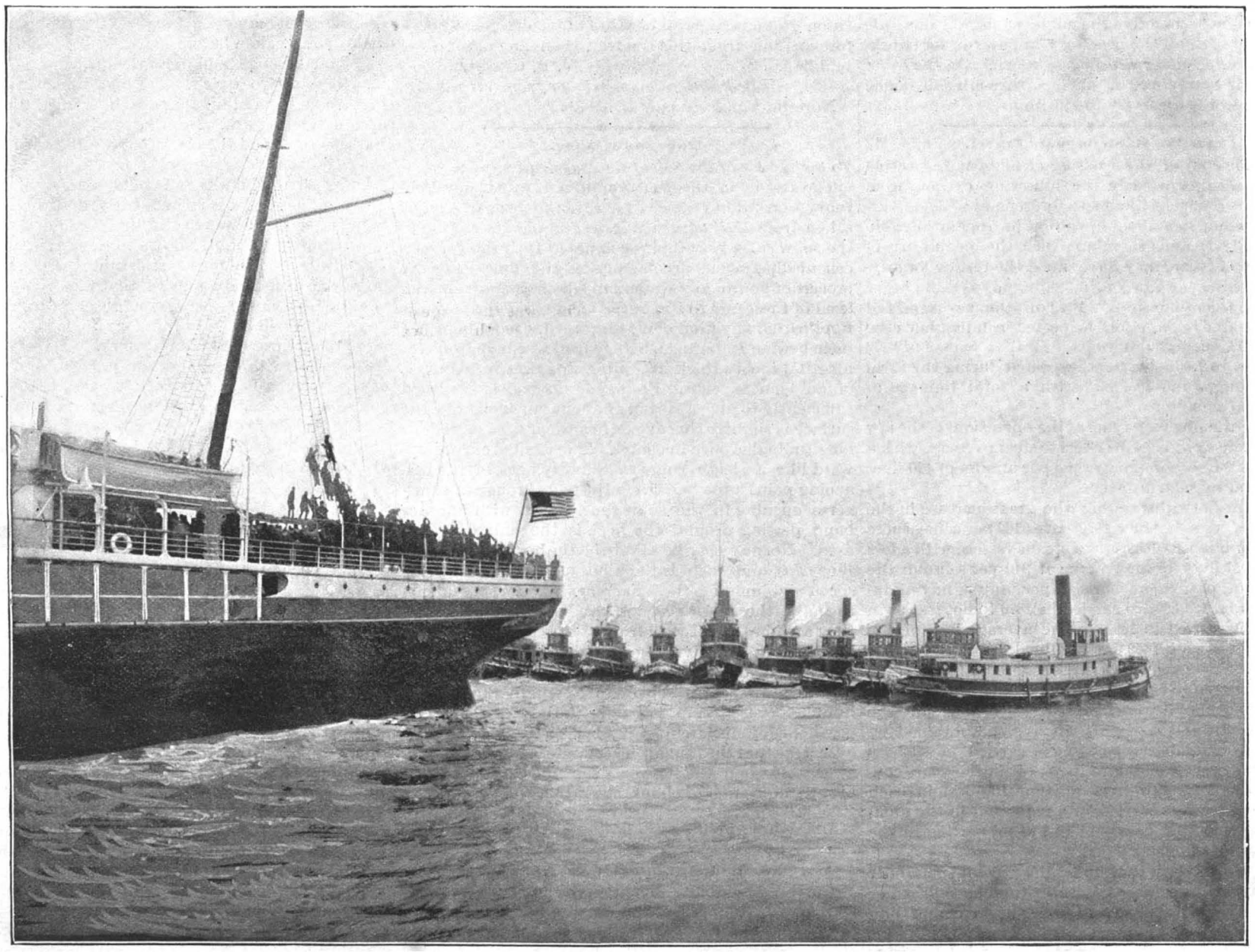
"It gives me pleasure to consummate here to-day, by the act of lifting this flag, legislation to which I gave my hearty support. [Applause.] I have felt as a citizen and as President the mortification which every American must feel who examines into the standing of the United States in the merchant marine of the world. I believed that we had reached an epoch in our development when the great work of internal development was so far consummated that we might successfully take up the work of recovering our fair share in the carrying trade of the world. [Applause.]

"We lift the flag to-day over one ship, a magnificent specimen of naval architecture, one of the best afloat on any sea. That event is interesting in itself. But its interest to me is in the fact that this ship is the type and the precursor of many others that are to float this flag. [Applause.]

"I deem it an entirely appropriate function that the President of the United States should lift the American flag."

While the outburst of cheers was at its height the President turned, and receiving the halyards from Capt. Jamison, he hauled the flag to its place on the top of the pole at the taffrail.

This act was the signal for which the multitude had lined the shores all day. They saw the flag as the wind caught it, and took up the cheering of those on shipboard, while all the adjacent steamboats let themselves loose with all the noises within the compass of their whistles. And while the whistling and cheering were at full blast, the band broke in with "The Star



RAISING THE FLAG ON THE STEAMER NEW YORK.

Spangled Banner," and the Chicago's guns and the guns at Governor's Island boomed forth a roaring salute.

One of our illustrations shows the appearance of part of the fleet of boats at the moment of opening their whistles, on the raising of the flag at the stern of the great steamer.

As part of the change of registry, the present ships drop the words "City of," and will hereafter be known as New York and Paris. The New York left New York on Saturday, February 25, on her initial trip to Southampton, and there again a big demonstration awaits her, as the whole town of Southampton is very much exercised over the prospect of having that port made the terminal of a modern transatlantic passenger steamship service. Heretofore these ships have plied between New York and Liverpool. But hereafter Southampton will claim them.

The abandonment of Liverpool for Southampton is calculated to save time and promote convenience, for vessels can go in and out at that port at any tide, and the ride from Southampton to London is only one and three-fourths hours. Special trains will run from all boats. Boats will leave Southampton weekly—at noon every Saturday—for the season.

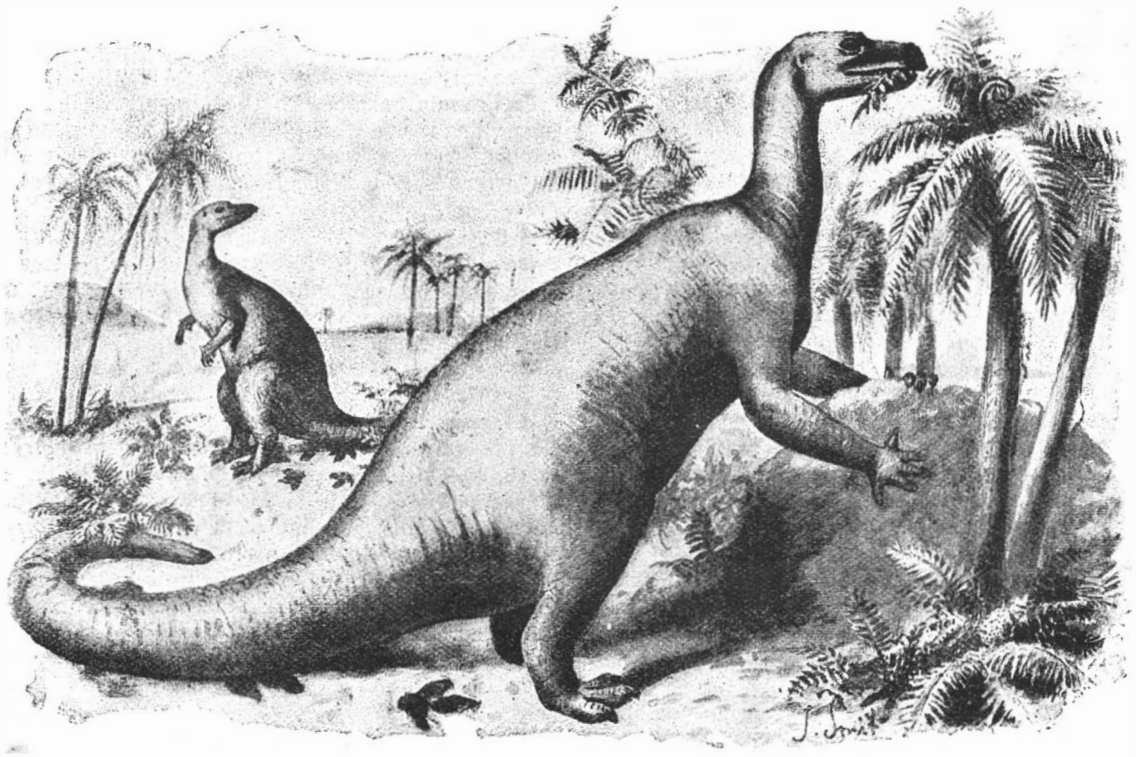
The New York will make her first trip to Southampton under an American captain, John C. Jamison.

Under the new law granting subsidies or bounties the new vessels must be built with a view to employment in naval service in the event of war. The New York and Paris have been so built.

The Navy Department has just designed a powerful battery for the New York. The battery will consist of twelve 6-inch breech-loading rifles, placed, one on each bow and quarter, and four on each broadside. In addition, there will be a secondary battery consisting of twenty six-pounder rapid fire guns placed on the main and hurricane decks, and eight one-pounder rapid fire guns mounted in tops. Each of the two masts of the ship will be given double tops. Each top will contain two one-pounder guns.

The New York is 527 feet long and 63 feet beam. The horse power of her engines is 18,400 and her tonnage is about 10,500. Her trial speed was 20·13 knots. She has two sets of cylinders and a stroke of 60 inches, and her working pressure is 180 pounds.

Under the old names the New York and Paris made great records as ocean fliers. The New York holds the record for the fastest eastern trip, 5 days, 19 hours, and 57 minutes, while the Paris lowered the colors of competitors on a western trip in 5 days, 14 hours, and 24 minutes. Both ships were the first to adopt the twin screw for ocean travel. The ship has a regular crew of 59 men and boys in the sailing department, and 198 men in charge of the engineer, Mr. John Wall.



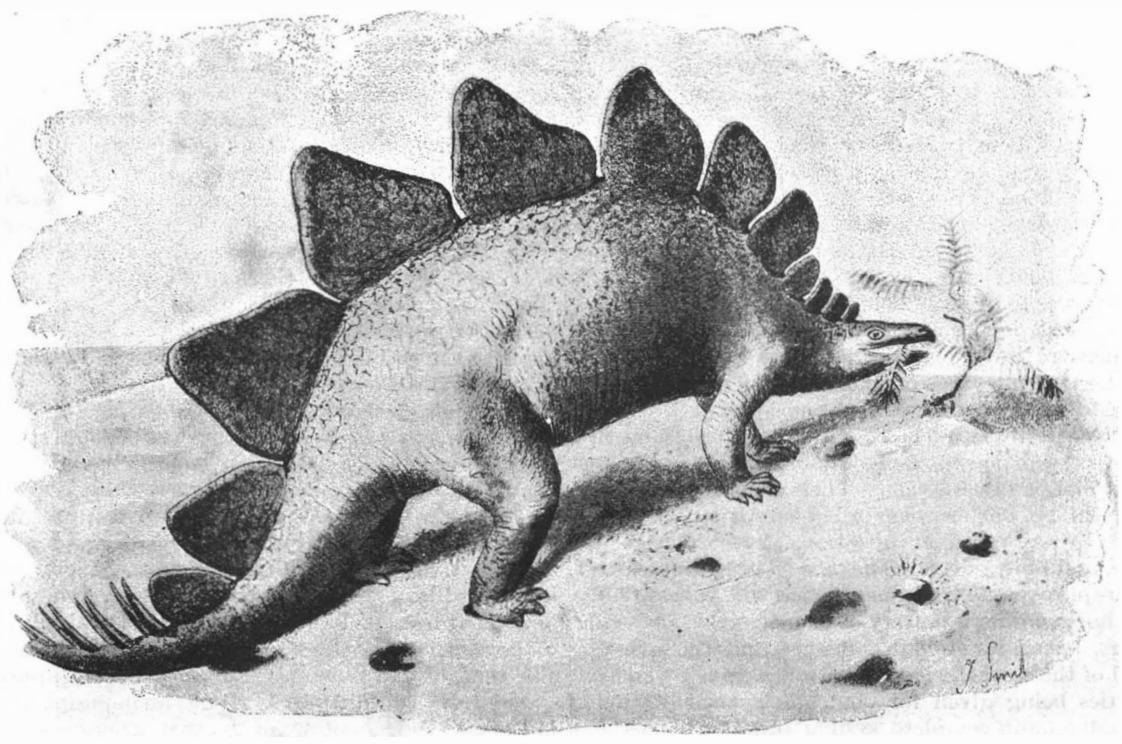
A GIGANTIC DINOSAUR, IGUANODON BERNISSARTENSIS. (LENGTH ABOUT 30 FEET.)

EXTINCT MONSTERS.

Cuvier it was whose fine imaginative reasons invented the great science of comparative anatomy and palæontology. His vast and splendid knowledge of existing beasts and birds enabled him to reconstruct from a fossil skull or a vertebra, sometimes from nothing but a single tooth, the long-extinct creature in its true semblance as it had lived—to clothe it with flesh and skin, and show it in imagination, in the haunts in which it lived and moved. This, which Baron Cuvier did in graphic description of great scientific and literary beauty, Mr. Hutchinson, in his work on Extinct Monsters, published by Messrs. Chapman & Hall, has now done popularly. Baron Cuvier showed how our planet was once inhabited by reptiles of enormous size and hideous aspect—the Dinosaurs.

The crocodiles and alligators are the degenerate descendants of these terrible primeval lizards—that in size and in their ungainly shapes were more like the dragons of our tales and legends than any beast that at present roams the earth.

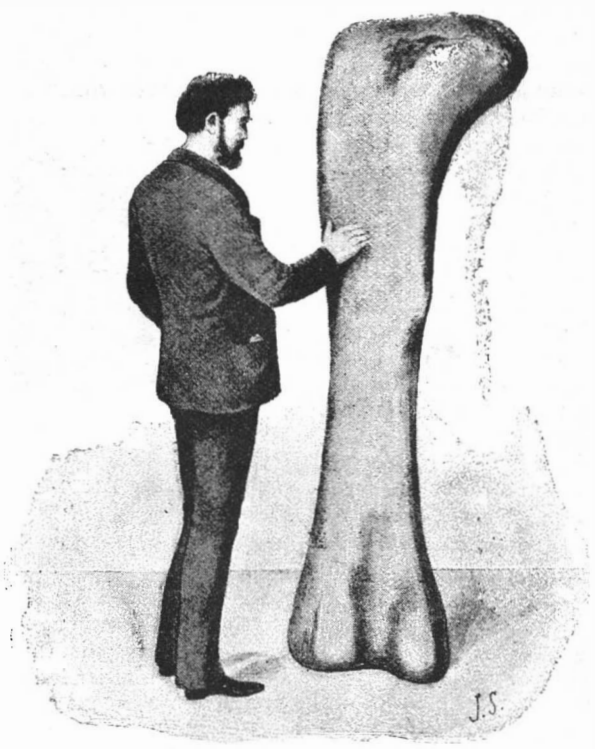
It is now established by science that, during the Mesozoic period of the world's history, evolution had proceeded so far as the development of life into the form of these strange reptiles. This was the "Age of Reptiles," but of such reptiles as the earth has not since held upon its surface. As yet mammalian quadrupeds did not exist. The horse, the ox, the elephant, the lion, the deer, and the thousand genera of four-footed mammalian beasts which tenant the earth to-day had not been created or evolved. The seas, the estuaries, the marsh, the forest, and the plain were lorded over by the Dinosaurs—reptiles indeed in a scientific point of view, but that mimicked in their structure and habits the nature of the mammalian quadrupeds of to-day. Of some of the Dinosaurs the bodies and limbs were as massive as those of our elephants and rhinoceroses. They were four-footed, but many of them walked the earth erect on their hind feet. Some were horned creatures of terrible aspect, feeding on vegetable food, while others were carnivorous animals with formidable teeth and claws. Most of the flesh-eating and many of the graminivorous Dinosaurs were kangaroo-moving creatures, with powerful hind quarters and the faculty of leaping as a kangaroo or jerboa leaps. In the case of the vegetable-feeding Dinosaurs it is conjectured that the creature was enabled to stand upon its hinder legs and feed on the branches of trees—as is here shown in the case of the gigantic Dinosaur known as *Iguanodon Bernissartensis*. The most terrible looking of these ancient monsters are by no means the carnivorous ones, as, for instance, the awful horned Dinosaur represented here, with helmeted head and skin studded with spiked armor bosses. These formidable means of offense and defense belong to a purely vegetable feeder, and the strength of the osseous skeleton, betokening a strong and active body, is a measure of the stress and struggle for existence during the reptile age. *Triceratops Prorsus*, though larger than the largest rhinoceros, was evidently armed and equipped against the attacks of the still larger, ferocious carnivorous Dinosaurian reptiles, of Atlantosaurus, for instance, of whom we know little but that his thigh bone measures 6 feet 2 inches in height, that his length could not have been less than 80 feet, and that if he traveled on his hind legs, as he probably did, he must have been tall enough to look in at the third story windows of a London house.—*Black and White.*



A GIGANTIC ARMORED DINOSAUR, STEGOSAURUS UNGULATUS. (LENGTH ABOUT 30 FEET.)

Sodium Peroxide.

This compound has been brought into commerce for use as a bleaching agent. It has the appearance of a yellowish, pulverulent, or partially aggregated mass, very readily soluble in water and hygroscopic. In contact with water, heat is evolved and oxygen disengaged, which excites coughing. Dilute acids give rise to the formation of hydrogen peroxide, but its decomposition must be prevented by cooling the liquid. Sodium peroxide may be handled without danger, but some caution is necessary in bringing it into contact with organic substances. It may be heated with dry aniline or benzine without risk; but when water is added to the mixture with benzine, it takes fire, with a kind of explosion. As compared with 1·5 per cent hydrogen peroxide (= 12 per cent by volume), sodium peroxide contains 20 per cent of active oxygen, and it has the advantage, as a solid material, of being more convenient for transport. It is also more capable of being kept, without alteration, than hydrogen peroxide. For convenience in use it is mixed with magnesium salts, and a material of this nature is made under the name of "oxygen powder." In using it or sodium peroxide care must always be taken to mix it with water in very small portions at a time and to prevent rise of temperature.—*Pharm. Centralb.*



THIGH BONE OF THE LARGEST OF THE DINOSAURS, ATLANTOSAURUS, FROM A CAST IN THE NATURAL HISTORY MUSEUM. (LENGTH, 6 FEET 2 INCHES.)

The Proper Piping of Dwellings.

There have been no greater advances in any department of building construction, and the conveniences attending all modern-built houses, than is shown in the matter of plumbing.

Our contemporary the *Mechanical News* has an article on the placement of water and waste pipes, and, while it may not convey anything new to our city plumbers, we are sure the information will be found useful to a great number of our readers, and especially to those residing in remote places and who are about to build.

The leakage of water pipes behind decorated walls and in fine ceilings is a sufficient argument against casing or covering service pipes. The repairs are generally costly in themselves, and they entail the additional services of the carpenter and decorator, as well as those of the plumber. Pipes in casings, or set in walls or partitions as they pass from floor to floor, provide especially inviting runways for mice, rats, and vermin of all kinds. Nests are built in these places; scraps of paper, rags, and food are carried into them, and they become filthy. It is only necessary to remove a covering board from almost any casing to prove this point in a most convincing manner. Even those in comparatively new buildings will be found surprisingly foul.

These casings or wall pockets, as the case may be, serve another and usually unexpected purpose. They act as ventilators and distribute odors from the kitchen and cellar to all parts of the building. In the performance of this duty they are faithful and impartial. The hollow walls and floors, which are nearly universal in the American system of construction, greatly assist in this work. Many of the fine French flats which were first erected in the city of New York are now rented with difficulty, owing to the odors which pervade them. When they are shut up for a short time they are almost unbearable. Rents have of necessity been reduced to one-third the original figure from this reason alone. The fault is usually found in the careless and ignorant arrangement of pipes and their cases. The odors from the kitchens are carried everywhere. Stale odors from closets and from food from kitchens and garbage boxes are mingled and distributed with perfect fairness to all the occupants. The large air shafts, usually held responsible for this state of things, have very little to do with it. The casings, open at the ceilings of each kitchen, communicate with all the floors and wall spaces and usually take their supply of odors from a point very near the range. All of them are directly connected with the cellar, and usually start in some way from the janitor's kitchen.

Numberless complaints, coming from new flats, of sewer gas are finally traced to the odors of cabbage, turnips, ham, onions, etc., which have come from the janitor's kitchen. In many buildings this kitchen is directly under the parlor of the first floor apartment and is separated from it by one thickness of boards and an inch of plastering. That there should be foul smells on the first floor is not to be wondered at. Tests of the plumbing in these cases are made and its protection proved.

There is nothing to be said upon the other side of the question.

There are no good reasons for putting pipes out of sight. When people say, in the face of these facts, that they cannot bear the suggestiveness of having the pipes where they are visible, they make an acknowledgment that they prefer hidden filth, danger to life, health and property to a right construction. Life and health cannot induce them to accept and frankly tolerate their plumbing work.

Pipes carried openly through a building are not dangerous, because their condition can be constantly observed. If accidents occur, the point at which the break takes place can be reached at once and repairs easily made. The quality of the work gains materially, because the plumber takes pride in putting up the work which is to be exposed.

Exposed pipes may be made to pass through floors without leaving an opening. The floors around the pipe can be made perfectly tight, and the passage of odors cut off completely—at least as perfectly as the nature of the plaster will permit. This is an enormous gain, while the runways for rats and mice, roaches and waterbugs are entirely done away with. These vermin can then be exterminated. This is practically an impossibility in houses where casings protect them and afford perfect breeding places. Cut off from free passage to all parts of the house, they prefer more congenial quarters, where rapid transit and fields for colonization are provided.

As decorative features of the rooms, cast pipes at least are often treated in a beautiful way. The body of the pipe is colored a very dark bluish-gray, scarcely removed from black. The bands are silver or nickel bronzed, or have silver or nickel leaf applied to them. Occasionally the whole pipe is finished with two or three shades of bronze. Lead and wrought iron pipe receive somewhat similar treatment. The lead is often polished and varnished. There is, however, no difficulty in making the decoration of the pipes strikingly effective.

It is satisfactory to know that architects and builders are beginning to break away from the old custom and expose their pipes wherever the prejudices of the owner can be overcome. Some of the best men in the profession are treating the plumbing work in a manner to show constructively its importance and value. The result is a great gain to owner and occupant.

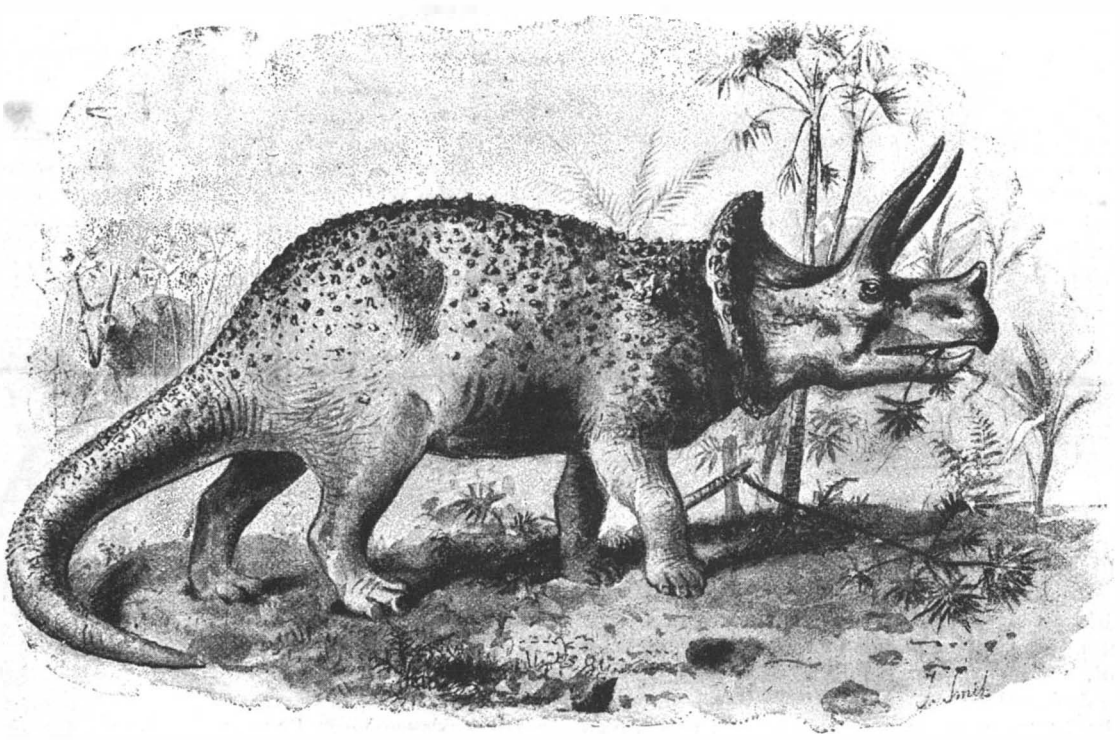
Progress of Lake Steam Navigation.

There is now a fleet of several handsome, high-speed side-wheel passenger steamers in the regular trade on Lakes Erie and Huron, says the *Marine Record*, and two others now under construction by the Detroit Dry Dock Company are expected to eclipse any of this type heretofore built.

The whaleback steamer designed for the transportation of passengers at the World's Fair, during the season of 1893, and recently launched from the yards of the American Steel Barge Company, West Superior, Wis., stands without a peer in the world; though her complete efficiency for passenger service remains to be tested, yet private passengers who have sailed on the whaleback type now afloat commend their easy motion and sea-going qualities, and in addition to these excellent features, the Christopher Columbus, as the new whaleback has been named, is to be fitted up in the most sumptuous manner ever devised; several unique departures in the outfit of high-class passenger boats will enter into her equipment, solely for the delectation of excursionists traveling on a or the "whaleback" model.

The handsome twin screw steel steamer Virginia, bult for the Lake Michigan passenger service of the Goodrich Line, is the largest and most efficient twin screw passenger boat now on the lakes. Her dimensions are 277 feet in length, 38 feet beam and 25 feet depth of hold; capacity 2,500 tons, and given 5,000 horse power to average 20 miles an hour speed.

The most modern type of exclusively passenger steamers for the lake trade are those now under construction at the yards of the Globe Iron Works Company, to the order of J. J. Hill, president of the Great Northern Railway. The contract price for these two steamers, which are to be ready for service for the season of 1894, is $550,000 each. Their general hull dimensions will be 380 feet over all (a length never yet attained by any vessel on the lakes), 360 feet keel, 44 feet beam, and 34 feet deep. They are to be equipped with quadruple expansion engines, which will develop fully 7,000 horse power, a battery of twenty-eight Belleville boilers, tested for a high pressure, and the average speed of the steamers is to be 20 miles an hour, special facilities being given for controlling their draught through a most complete system of water ballasting. It is a matter of congratulation that the entire construction and equipment of these splendid steamers will be of distinctively American manufacture throughout.



A GIGANTIC HORNED DINOSAUR, TRICERATOPS PRORSUS. (LENGTH ABOUT 25 FEET.)

THE GREAT EXPOSITION—DOORWAYS TO THE TRANSPORTATION BUILDING AND THE WOMAN'S BUILDING.

In general, the entrances to the more important buildings at the World's Columbian Exposition form part of a harmonious whole. They appear ample, and do not belittle, neither do they seem to be too pretentious.

The only exception to this general rule is the magnificent main entrance to the Transportation Building, which is a rare conception in detail and in effect. Probably no staff work at the exposition has attracted the attention that this entrance has.

This entrance, usually called the "Golden Doorway," is 100 feet wide and 70 feet high. It consists of a series of seven concentric arches. The first arch has a radius of nine feet, while the largest has a radius of thirty-eight feet, with a total height of fifty-two feet. In the semicircle space of the inmost arch, but not shown distinctly in the illustration, the words "Transportation Building" stand out in bold letters. Above is a semicircular allegorical relief representing the Genius of Transportation. Various figures typify the earth, the air, the water, sunlight, electricity, and animal power controlled and directed by human intelligence. On the spandrels of the arched doorway will be mural paintings, one showing a full-rigged vessel with all sail set and plunging through the sea, and the other a train of cars and locomotive running at full speed.

At the base on each side is a large relief twenty-three feet long by six feet deep. These typify scenes beginning with the stone age and ending with the time of the Pharaohs. Within the recess of the arch are two smaller panels, one on each side, and each fourteen by six feet. On these also in bold relief are represented the earliest types of carts drawn by oxen, and also modern transportation facilities, the interior of a sumptuous palace car, and the gang plank of an ocean steamship. The faces of the arches themselves not covered with these reliefs are ornamented with medallions, arabesques, and foliated designs.

Above the arched entrances, with an overhang of ten feet, is a terrace, the surfaces of which are also elaborately ornamented. This balcony breaks the rigid effect of the entrances. Elevators within the building will carry passengers to the top of this balcony, where there will be a restaurant capable of seating between four hundred and five hundred people. The view from this is very commanding, taking in the whole of the lagoon, all the buildings from the Art Gallery on the north to the Agricultural Building and Palace of Mechanic Arts on the south, while there is a full sweep of Lake Michigan over the vast expanse of roof of the Manufactures and Liberal Arts Building. Startling effects in color will be produced on the Transportation Building, and it will be the only instance of polychrome decorating at the fair. The Golden Doorway will be covered with leaf aluminum, and this in turn will be varnished with transparent varnish, of a strong golden hue, producing a very close imitation of gold leaf effect. The whole building and particularly this entrance has been harshly criticised because of the present strong red color. The fact is, this is only a priming color. When the coloring is completed the building will be very light in effect, while strong effect will be given much of the relief work of the entrance by working color into the interstices.

The main entrance to the Woman's Building is modest, but in good keeping with the general style of the building, which is Italian renaissance. In coloring the effect will approximate ivory white. There is little or no attempt at ornamentation, except in the one relief which typifies woman in history.

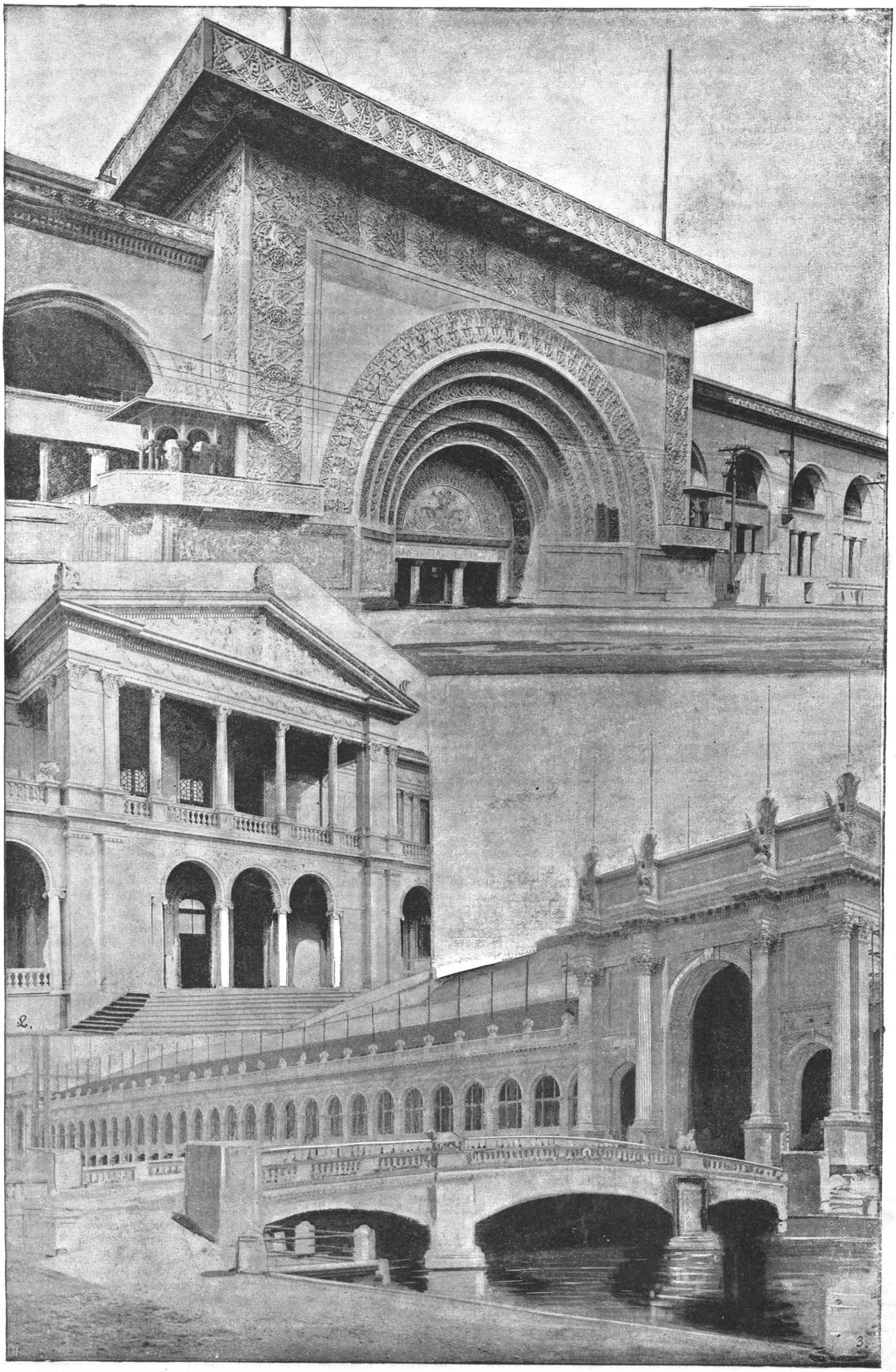
The entrance of the Manufactures and Liberal Arts Building illustrated is the west entrance, and is very prominent from its location opposite the main lagoon at the south end of the wooded island. This entrance, like that of the Woman's Building, will be approximately ivory white in effect. It has an imposing effect, and breaks the monotony of the vast expanse of building and roof that extend north and south from it The

main arch is 81 feet high, and the two lesser arches 47 feet high. On tablets directly over the smaller arches in bold relief are the words "Manufactures and Liberal Arts." In the space within the main arch is ornamentation not shown in the picture, and on the three surfaces in plain letters the word "Manufactures." Directly over the tablets, already referred to, on the outer walls, above the smaller arches are large rectangular inscribed tables.

This entrance is strongly Corinthian, and a finely executed eagle surmounts each column. In the spandrels of the main arch are graceful female figures, while within the recess of this arch is an allegorical relief, representing Manufacturing. The ornamentation directly over the spandrels of the small arches consists only of Cupids.

Our Railroad Army.

There is an army of men employed upon the railroads of the United States, an army of 784,000. They are not engaged in idle maneuvers, dress parades, barrack drills, or preparations for warfare, but by their diligence, energy, and toil contribute immensely to the wealth, well being, and development of the country, the interchange of its products, the diffusion of information, and the prompt transportation of vast numbers of passengers, with a remarkably low percentage of casualties. The number of passengers carried last year was 530,000,000. The number of passengers killed was 293.



THE WORLD'S COLUMBIAN EXPOSITION—ENTRANCES TO THE TRANSPORTATION, THE WOMAN'S AND THE MANUFACTURES BUILDINGS.

RECENTLY PATENTED INVENTIONS.

Engineering.

TRACTION ENGINE.—Logan M. Medlin, Latham, Mo. This is an engine of simple and durable construction arranged to impart power to all four wheels simultaneously, at the same time permitting steering of the engine at the front wheels. A compensating gear wheel arrangement is provided between the rear and the front axle, by means of which the power developed by the engine is economically used and compensation is made for any slip difference in the motion of the drive wheels. The engine has a belt pulley for transmitting power to other machinery.

DREDGING APPARATUS.—Joseph E. Kauser, Pensacola, Fla. This apparatus is provided with a conical discharge or ejector pipe having a reciprocating motion, the lower end of the pipe being immersed while at work, and the upper contracted end connected with the discharge, while a blast pipe from a suitable source of air supply is connected with and discharges into the discharge pipe. The pressure upon the discharge pipe is increased or diminished according to the toughness of the soil worked upon, and the dredged matter coming in contact with this pipe only, there is no danger of injury to the working machinery.

Railway Appliances.

CAR COUPLING.—Thornton E. W. Fay, Philadelphia, Pa. The mechanism of this device is entirely concealed within the drawhead, so there is no danger of clogging up with snow or ice, and the device is strong, simple, and easily operated, automatically engaging the draw-bar of an opposing coupling. Combined with the coupling is a bumper plate adapted to receive the thrust of the car, the plate being backed by springs in such a way that when two cars come together the shock is thus absorbed.

CAR COUPLING.—William P. Clark, Elberton, Ga. This invention relates to improvements in automatic couplings of the Janney type, which employ revolving knuckles, and the device has forwardly extending arms, one carrying a revolving knuckle and the other an outside hook to engage the knuckle of an opposing coupling. The two knuckles of the two couplings thus act independently to engage independent arms or hooks, and when one knuckle breaks the other will still hold the cars together. The coupling is of inexpensive and simple construction, and well adapted to withstand the wear and tear of severe service.

SWITCH STAND.—Morris G. Prutzman, Lehigh Gap, Pa. This stand comprises but few parts, and is adapted for either automatic or hand use. It is of that class of stands in which the switch-actuating rod is connected with a spindle of the switch stand, and is adapted to operate in connection with automatic split switches. The improvement provides a more direct automatic action by dispensing with auxiliary parts which are a source of wear and lost motion, and provides for locking the stand direct to the spindle, independent of the hand lever, thus better guarding against tampering, while the parts are so arranged that if any foreign body is caught between the rails to interfere with the working of the switch it will at once be noticed.

RAILROAD FROG.—David Horrie, Kaukauna, Wis. This is an improvement upon a formerly patented invention of a combined frog and switch of the same inventor, in which a swing rail upon a frog is connected in sequence with converged shifting rails of an adjacent switch, operating mechanism being adapted to release a locking device for the swing rail and simultaneously adjust the rail and the switch rail to align with the main track or side track in either direction of travel.

TRAIN ORDER AND SIGNAL.—Leonard T. Crabtree, New London, Wis. This is an improved signaling device to co-operate with a train order annunciator used on railroads employing the block system. The invention provides a novel mechanism for setting and ho ding a semaphore or other visual signal over a railroad track at a way station, where orders are awaiting an approaching train. The train order annunciator in the way station office to indicate the train to receive orders, and co-acting with the signal device, is similar to one formerly patented by the same inventor

Electrical.

ELECTRIC MOTOR REGULATOR.—Joseph A. Williams, Canal Dover, Ohio. Combined with the armature shaft is a centrifugal governor having a spindle provided with a pair of friction disks or gears, and the brush-carrying arm having a toothed sector, while a shaft parallel with the drive shaft and geared to the sector is mounted at one end in a sliding frame, in which a transverse shaft is also mounted and geared to the parallel shaft, and carrying at its lower end a friction disk. The improvement affords a simple and effective regulator which will maintain a uniform speed under varying load.

Mechanical.

COMBINATION TOOL.—Benjamin F. Field, Elmira, N. Y. The members of this tool, when assembled as one implement, afford a convenient device for use as a surface gauge, a box square, a level, a trammel gauge and a scribing gauge. Some of the component parts when detached are serviceable as separate tools for specific purposes. The combination tool is well adapted for the use of machinists, in the placing and gauging of work in process of execution, on a metal planer or lathe, and also in the erection of various kinds of machinery.

PARALLEL VISE.—Joseph Schwendemann, Reutlingen, Germany. This invention provides an improvement whereby the position of the vise can be conveniently changed relative to the work bench on which it is applied, and by which the vise can be fastened in place after the desired adjustment is made. The vise may be moved farther inward or outward from the front edge of the work bench, or set at an angle thereto, and when the proper adjustment has been made a winged nut is screwed up to clamp the vise in place.

PIPE WRENCH.—George W. Morrill, Alton, N. H. This tool has angular and toothed jaws having oppositely recessed faces to permit them to cross each other, and with shanks of unequal length pivoted one upon the other, a handle being pivoted near its end to the end of the longer jaw shank, while a link connects the end of the handle to the shorter jaw shank. The wrench is of simple construction, having a maximum of strength in but few parts, and it is quickly adjustable to any size of pipe, with which the wrench may be firmly brought to a locking engagement, enabling the pipe to be turned in any direction without danger of slipping.

OIL CUP.—William F. Althoff and John H. Stokesbary, Denver, Col. This oiler is more especially designed for use on loose pulleys and other wheels and parts to lubricate them effectively and only when the part is in action, the flow of the lubricant being then proportioned to the speed of the pulley. On the bottom of the cup is a bored screw-threaded offset, to be screwed in the hub of the wheel to be lubricated, and in this offset fits a pipe extending almost through the body of the cup and close to its inner surface, the oil being forced into the end of this pipe by the centrifugal motion when the wheel is revolved.

Agricultural.

SEED PLANTER.—George A. Stine, Spokane, Washington. Combined with the seed box is a rocking frame operating about a vertical axis and having at its lower end an arm outside the box and its other end bent down inside the box to form a stirrer, with an oscillating feed plate, and other novel features. The device is adapted to plant seed in hills or rows, and in a greater or less quantity, as well as seed of different sizes and also a variable distance apart.

CULTIVATOR.—William A. Wagner, Central City, Iowa. This is a machine more especially adapted for the cultivation of corn, and has one or a series of separators to divide the clods and remove them from over the rows, also removing weeds, rubbish, etc. Each separator has a detachable harrow for cultivating the ground, and there are rollers at the back of and between the separators, which crush the clods and weeds. The frame carrying the separators and harrows may be made in sections, so united that the machine will accommodate itself to the undulations in the ground.

Miscellaneous.

PIPE COVERING.—James L. Covel, Naples, N. Y. This invention provides a composition for treating paper and rendering it suitable for a pipe covering, refrigerator lining, and roofing material, etc. The compound consists of wheat flour, pulverized alum, arsenic, red lead, litharge, and other ingredients, in stated proportions and prepared as described. Paper prepared or coated with this compound may be applied in a succession of sheets or layers, and a series of air spaces can be formed with the paper around the pipe, making the covering more effective.

ELEVATOR DOORS.—Edmond M. T. Boddam, Sydney, New South Wales. An improved device for automatically opening and closing the doors leading to the shafts of hydraulic elevators is provided by this invention. The improvement consists of a hydraulic ram connected with the door, a valve controlling the ram, and a double valve controlling the inlet to the single valves for the several doors, the double valve operating in conjunction with the valve which admits water to the lift or elevator cylinder.

BUCKET DUMPING APPARATUS.—Frank B. Wineland, Breckenridge, Col. This is an improvement in devices for hoisting buckets used to raise water, ore, and other material from a well or mining shaft. Combined with a vertically movable hoisting bucket having projecting trunnions thereon is a swinging door arranged in the path of the bucket and provided with supporting arms adapted to engage the bucket trunnions. The construction is such that the buckets are practically self-dumping, and the door at the top of the shaft is closed as the bucket ascends, preventing the material from dropping back.

HOSE WASHER.—John E. Taber, Fall River, Mass. A casing formed in two compartments has a perforated piping in one and a rotary table or reel for soiled hose journaled removably in the other, and from which the hose may be unwound and passed through into the washing compartment. The improvement is especially adapted for use in a fire department for washing hose after a fire, occupying but little room in an engine house, the hose being placed in one compartment and drawn from the casing thoroughly cleaned.

MUSICAL BLOCK.—Annette S. and Goodridge S. Bowen, New York City. This is a block suitable for children to play with, and a series of such blocks are provided, each bearing on its face the name of a certain note, the note itself, and its position on the staff, while the block is also provided with interior mechanism for sounding or producing the note represented. When eight blocks are thus used, capable of producing all the notes of the natural scale, the invention is designed to afford a most efficient means of teaching children.

SECTIONAL COOKING BOILER.—Charles W. Wynn, Asheville, N. C. This invention relates to sectional steam cookers, and more especially to the means for separating the several sections when it is desired to lift one from the other, obviating the danger of burning the hands or spilling any of the contents of the boilers. The different sections of the boiler have a telescopic connection with each other, and the sections have at their upper ends swinging handles, each formed with an angle member and an upwardly extending lifting finger pivotally connected at its lower end to the free end of the angle member, by which the sections are readily forced apart as the handles are grasped.

STEP LADDER.—William P. Stibbs, Belleville, N. J. This is a ladder which may be folded in small space when not in use, and is constructed in connection with a box or casing in which the ladder folds, the casing being adapted for use as a stool, ottoman, or piece of furniture, and having also a drawer adapted to contain tools. The box or casing is provided with casters, and means for drawing them up into the box when the ladder is to be used.

TROUSERS PROTECTOR.—Richard T. Matheson, Brooklyn, N. Y. This device consists of a strip of material to which are attached pliable pins, by means of which the strip may be readily and securely fastened as a guard to the bottoms of trousers legs. The strip is formed of leather, rubber, or a stout piece of cloth or felt, and the attaching pins are preferably made of copper, the device being readily attached by the wearer.

BARREL HEADING PRESS.—Bradford S. Miles, Gray's Summit, Mo. This invention is designed to simplify the construction of barrel-heading presses and economize in their manufacture, producing also a machine the follower of which exerts an even tension on the head of a barrel, and insures the head being simultaneously entered into the croze without injury to the articles packed in the barrel. The machine can be quickly and easily applied to a barrel, and, in consequence of the gearing employed, is operated with great speed.

LAMP CHIMNEY ATTACHMENT.—Joseph E. Wenman, East Liverpool, Ohio. This is a device for medical, vaporizing and heating purposes, and consists of a perforated metal tube and attached cap device designed to rest upon an ordinary glass lamp chimney. The cap serves to protect the rubber inhaling or vaporizing tube of a medical vaporizing retort carried by the tube.

CAP FOR CHIMNEYS, FLUES, ETC.—Herman Moeller, Brooklyn, N. Y. This invention provides a device of simple and durable construction designed to afford a perfect draft, no matter where the flue or chimney capped may be located. The body of the device consists of a series of tubes circularly arranged, the construction being such that, should one conduit fail to act, an auxiliary conduit will perform the functions.

FENCE WIRE REEL.—Sylvester Moore, Audubon, Iowa. This is an improvement on a former patented invention of the same inventor, especially in the construction of the spooling bar, wherein one fence wire is carried to or from a reel above the bar and the other beneath the bar, thus equalizing the strain. A clutcher is also provided for the driving gears capable of being quickly and easily applied while the device is in operation, the driving wheels being relieved from the frictional contact of the clutch.

MATCH SAFE AND CIGAR CUTTER.—George F. H. Hicks, Chicago, Ill. This is a convenient device which carries the matches in such a way that they can only be taken one by one from the case, having a pick which automatically lifts a single match from the safe, with means for automatically striking the match as it is lifted. The scratcher may be thrown out of use when an unlighted match is desired, and connected with the casing is a cigar-cutting attachment.

DEVICE FOR HANDLING LIQUIDS.—Stuart R. Mace, Moulton, Iowa. This invention consists principally of a receiving vessel provided with a siphon, one leg of which is adapted to pass into the receptacle, while a dipper adapted to pass into the receiving vessel acts as a plunger for starting the siphon, and is adapted to withdraw a measured quantity of liquid from the receiving vessel. The device is especially adapted for handling oils, etc., transferring the liquid from one receptacle to another without loss

CORK MAT FOR BATH ROOMS.—Andrew Merton, New York City. Combined with a border frame rabbeted on its lower inner edge, with metal angle pieces for corners, and a bottom board, is a tesselated frame within the border, and cork blocks fitted in the interstices of the tesselated frame and in contact with each other edgewise. The soft, slightly elastic and warm surface of the cork facing of the mat causes it to be very agreeable to the naked feet, and a very superior foot mat is thus afforded for use in bath rooms.

SNAP HOOK.—Anthony B. McDowell, Edna, Texas. This is a device adapted particularly as an attachment for riding saddles and harness, as a means of suspension for whips, ropes, or other articles, which may be attached to and detached from the hook without requiring the spring to be depressed by manual pressure.

Designs.

SPOON.—Marshall O. Roberts, Washington, D. C. In the handle of this spoon is a miniature likeness of John Howard Payne, author of "Home, Sweet Home," and in the bowl is a figure of a homestead, intended to represent that of the author.

STOVE.—Isaac De Haven, Allegheny, Pa. This design has several leading features, including ornamental representations on the top, the name plate, the hood, pilasters, base and legs, the blower, and the front,

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE PRACTICAL POLISH AND VARNISH MAKER. A treatise containing 750 practical receipts and formulæ. By H. C. Standage. London: E. & F. N. Spon. 1892. Pp. x, 260. Price $2.50.

The manufacture of varnish has long been considered a trade secret. In the present work we find any number of varnishes described very fully, and it looks as if the art of making varnishes could hardly be considered a full trade secret any longer.

THE HISTORY OF THE BAND SAW. By W. Samuel Worssam, C.E. Manchester, England: Emmott & Co. 1892. 8vo. Pp. 41, 31 illustrations, paper. Price 60 cents.

This is an interesting little work by a man who is well known not only as an author of other treatises on saws, but also as a saw manufacturer. Speaking of the band saw, Mr. Worssam says: "I may mention that, traveling in the United States in 1860-61, with the object of seeing the kind of wood working machinery in use there, I never came across one of these saws, and the prejudice against them was universal. . . Since then these jigger and scroll saws have been almost entirely discarded in favor of the band saw." This is indeed a wonderful development and the present work briefly outlines the various steps which have led to the result noted above.

LE THÉ BOTANIQUE ET CULTURE. Par Antoine Bietrix. Paris: Librairie J.-B. Bailliére et Fils. 1892. Pp. 160. Price 2 francs.

The cultivation of tea, its botany, its adulteration, and its richness in caffeine in different species, is the subject matter of this little work, and in thus giving the subject matter the outline of its contents is presented. It is all excellently treated, the illustrations of apparatus and discussions of methods of analysis, and the microscopy of its adulterations, are all included, and make it quite a valuable contribution to the subject in question.

HOW TO MAKE A ONE HORSE POWER MOTOR OR DYNAMO. By A. E. Watson. Illustrated. Lynn, Mass.: Bubier Publishing Company. 1893. Pp. 50. Price 25 cents.

THE "NON PLUS ULTRA" SODA FOUNTAIN REQUISITES OF MODERN TIMES. Edited by G. H. Dubelle. New York: Spon & Chamberlain. London: E. & F. N. Spon. 1893. Pp. 160. Price $2.50.

The soda water business has attained so great a development in the last few years that the above work, containing a very large series of formulæ for all kinds of soda warer mixtures, is exceedingly timely. In looking over it, it is hard to believe that anything of importance has been omitted. The dispenser who wishes to be well up in the times cannot do better than to use such works as the present with its exhaustive formulæ. The author believes that druggists should prepare their own sirups and thereby acquire a reputation for selling fine soda water. He also states that pure fruit juices have almost entirely superseded artificial fruit essence sirup. This, of course, is a result strongly to be wished for, and the author is pronouncedly in favor of the practice.

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Patent Open-Side Planing and Shaping Machines. Pedrick & Ayer, Philadelphia, Pa.

For Sale—Patent 486,329. Address H. E., care box 266, Jackson, Mo.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Stow flexible shaft. Invented and manufactured by Stow Mfg. Co., Binghamton, N. Y. See adv., page 111.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

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Hydrocarbon Burner (Meyer's patent) for burning crude petroleum under low pressure. See adv. page 381. Standard Oil Fuel Burner Co., Fort Plain, N. Y.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Kennedy Va ve Mfg. Co., manuf'rs of brass, iron gate valves, patent indicator valves, fire hydrants, globe, angle, check, radiator, and safety valves, 52 Cliff St., N. Y.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(4707) F. L. asks: Can you tell me the weight of the heaviest steam hammer in the world? By this I mean the hammer alone, with nothing connected, such as ram or piston rod. I should also like to know if the power is only used to raise the hammer when working, or is it used also to strike the blow as well? A. The weight of the head alone of the 100 ton Creusot hammer, the largest, is said to be 60 tons, the whole weight of piston rod and piston bringing the weight up to 100 tons. The hammers of this class are rated by the total weight of the moving mass. See interesting details of the great hammers in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 488 and 703.

(4708) C. M. C. says: If we anneal cast steel several times, it will not harden. This I know by experience. Do we add carbon, or diminish? A. In the ordinary method of heating steel many times, enough carbon is supposed to be lost from the surface layer to prevent hardening. There is also a change in the crystalline structure of the steel by which the combined carbon becomes graphitic and thus prevents hardening.

(4709) C. S. asks: Will you please give me information as to cost of patching of shaft of steamship Umbria, as I had a dispute as to its cost. A. The repairs made in New York are estimated to have cost about $4,000.

(4710) G. B. E. writes: Can you tell me the size, and where the largest telescope lens is? You will confer a very great favor if you can and will answer this for me. A. The largest telescope lens is 40 inches diameter, now in process of finishing at Alvan Clark's Sons, Cambridge, Mass.

(4711) G. F. asks: Will a twist drill cut better with or without oil, and which is the most economical; (through cast steel)? A. Twist drills cut best with oil in wrought iron and steel. Dry in cast iron.

(4712) L. M.—The berries of the Phytolacea are not exactly poisonous, but they possess emetic properties that render them unfit for human food.

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February 21, 1893,

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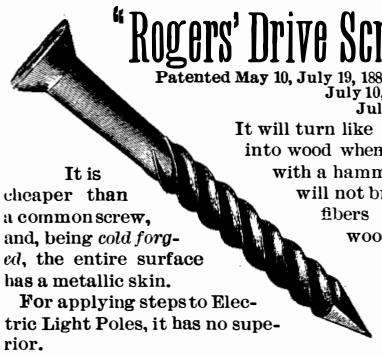

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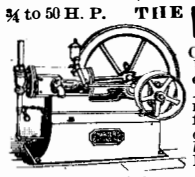

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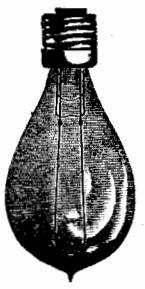

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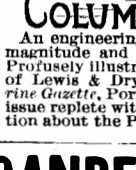

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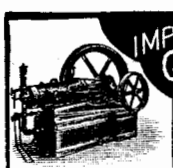

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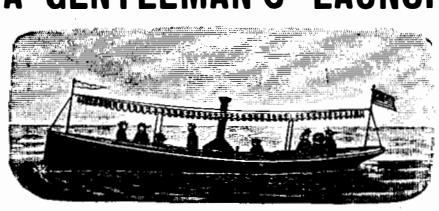

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